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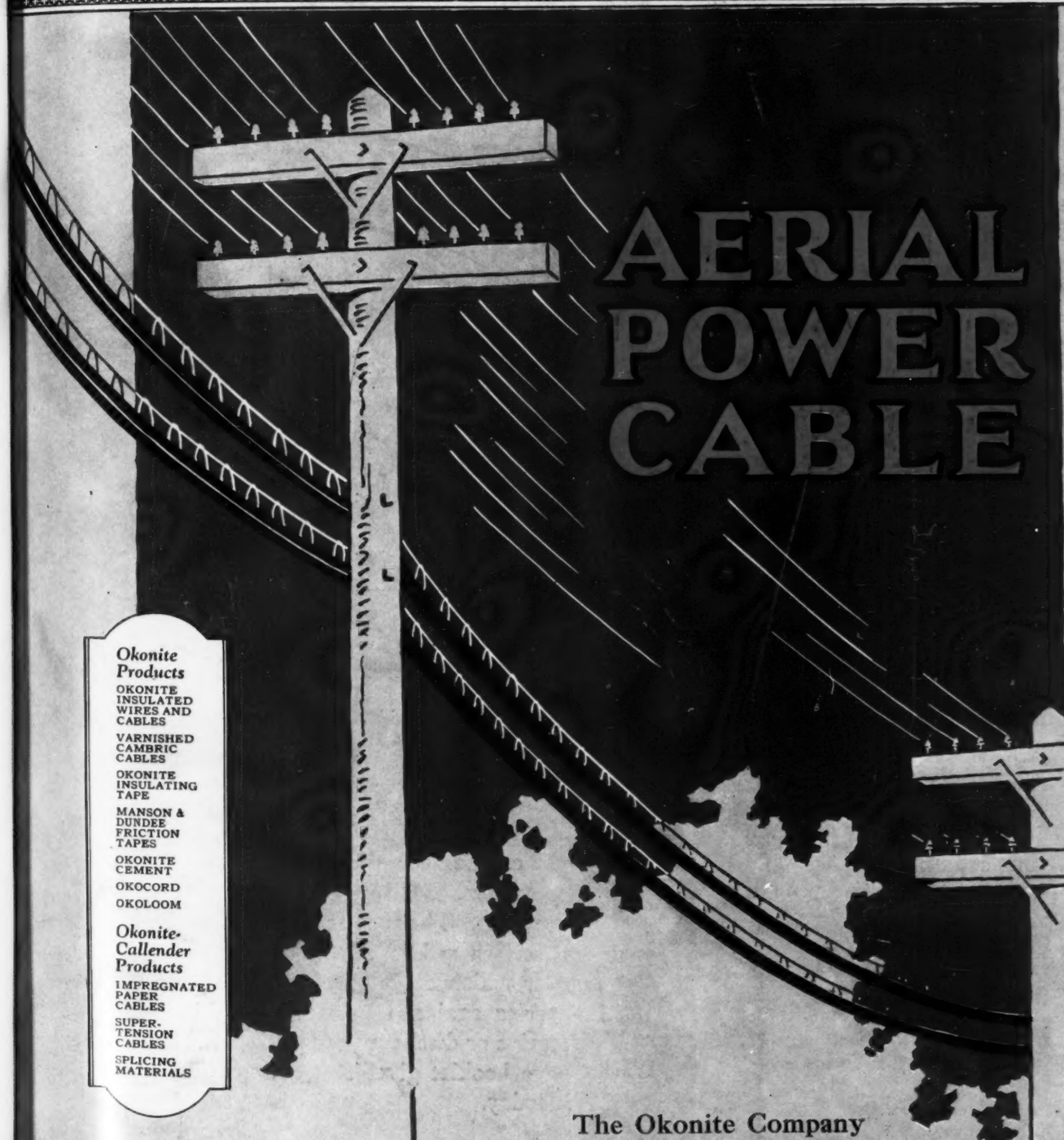

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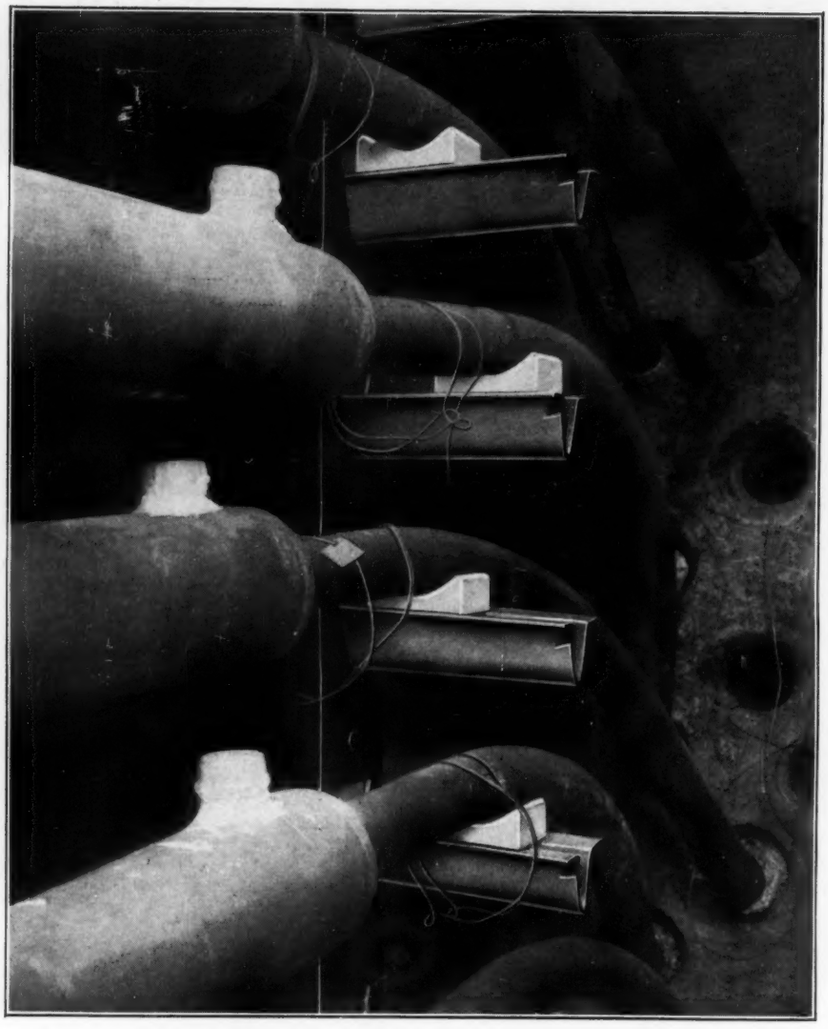

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Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 90 — *New York, Saturday, July 23, 1927* — NUMBER 4

The Volta Centenary

AT COMO, ITALY, there will be celebrated during September the centenary of Alessandro Volta. For reasons best known to themselves the Italians single out this time the year of Volta's death, 1827, rather than 1745, the year of his birth, for commemoration; but none the less the event promises to be a memorable one. National and international congresses of pure and applied science have been announced and invitations have been issued to the scientific societies of the world. Chief interest for this country and the electrical industry in particular will center around the meeting of the International Electrotechnical Commission and that of the telegraphic conference. It will be recalled that the telegraphers of this country attached a wreath of bronze to the Volta monument in Como during the great Volta centennial exhibition of 1899 commemorating the discovery of the electric pile.

Few events in electrical history have been more striking than Volta's discovery, modifications of his primary battery being in wider use today than ever. Telegraphy and telephony are essentially the offsprings of the Voltaic cell, and what a tremendous impetus to its wider use has wireless given. Italy then was part of the grand tour and no philosopher thought a trip to Italy complete which did not include a visit of homage to the illustrious Volta. He was widely known and honored in his day by Italy, France and England and his native land does well in keeping his memory alive. Italy has given the electrical world many illustrious sons, and for their sakes, as well as her own, the world is glad and proud to do her honor.

Common Sense and Utility Regulations

RULES and regulations have been essential to the success of organized enterprises since the dawn of business history, but in the public utility field we like to think that in emergencies intelligent employees will use some discretion in carrying out routine instructions, even at the risk of being "called on the carpet." A recent trifling incident points a moral in this direction which deserves consideration. While an editorial call was being made at the office of one of the leading communication companies of the country another such company telephoned to ascertain the exact time of day. The information was refused on the ground that the rules forbid giving the time in response to telephone inquiries, the demand for such information having become burdensome during a period of years when this particular service was open to the public. Even the august name of the inquiring company was of no avail, and the rules won. There is something humorous in the failure of one multimillion-dollar utility to overcome the unwillingness of another to transmit to it the most commonly sought information of the civilized human race, but as organizations grow these little episodes become more frequent than a good many executives realize. We find them in customer relations in our own branch of the industry, in carrying on merchandising, locating poles, handling service applications, and in other activities. Once in a while we need to appreciate that the mere wooden observance of rules without comprehension of their limitations may lead to failure in public service under critical conditions. The leading executives of our industry are encouraging its men and women to carry responsibility, and this means that where controlling reasons exist proper action may be taken. Team play rather than military administration is the basis of their policies.

A Step Toward Unity in Inspection Practice

APPARENTLY there is good promise of early action among the inspectors of the industry to effect a nationalization of the numerous associations of municipal and insurance underwriters' inspectors now operating more or less independently in various sections of the country. Such a development will be welcomed by all electrical men, for although the inspection service has never been considered an integral branch of the electrical industry, it is nevertheless the protecting police authority which by common consent has been set up and maintained to insure the observance of the established laws of safety in the installation of electrical wiring and equipment. And it is manifestly improper for this great national industry, with its nationally distributed products and its national policies, to intrust the enforcement of its national code to men who operate in sectional groups, without national consciousness—no matter how sincere and able they may be.

For a long time leaders among the inspectors have felt the incongruity of this situation and the practical need for national unity in the interpretation of the code. Out of this has crystallized a growing sentiment for a consolidation, or at least a co-ordination, of the several now separate associations of the East, the Central states and the Far West. Ways and means of overcoming the barriers of tradition and bringing about such a combination have been under very active discussion of late. The plan now seems to be trending definitely in the direction of the organization of an international association to embrace the entire United States and Canada, with the present associations continuing as sections and holding their own conventions, their directorates combining to form the industry council in "the international." For convenience in operation some of the present sectional associations would probably be broken

up into more than one section, and within these, in turn, chapters might be formed to facilitate local work.

It is an appealing plan. It would be impracticable to attempt great national conventions of all the inspectors. These men can spend neither the time nor the money which this would entail. And it is not necessary. The chief need is to tie the sectional groups together in a unity that will result in uniform interpretation of the code and uniform inspection practice, among state, municipal and underwriters' inspectors alike. And this can be well accomplished by such a relationship under the guidance of a central council.

Meter Saturation Is Not Market Saturation

"NINETY-EIGHT per cent of our residences are wired for electric service; our business will grow from now on through the overcoming of stiff sales resistance, and we cannot expect rapid expansion of our company in the face of these conditions." This remark of an experienced power-company manager in a recent conference should strike fire, for it challenges sales ability to prove that the obstacles hinted at are exaggerated and that commercial saturation is a meaningless term even in an old-line community with ultra-conservative habits like that occupied by the company in mind.

The acquisition of new customers is a symbol of company expansion, but the days of record-breaking additions to the meter list are fast passing. Growth of business is no longer a function of the number of new customers taken on during a given period. The test today is in the use of the investment in the consumption of energy by every class of customers. The percentage of buildings adequately wired is little less than mortifying to industry executives willing to face the facts and take constructive steps to remedy the situation. Not one home owner in a hundred has the least conception of a residence completely equipped for the use of electricity, and altogether too few architects grasp the needs of a really modern establishment in the matter of electrical facilities. The number of outlets in service per home is still painfully small, and organized effort to sell these by the co-operation of the various branches of the electrical industry in individual communities is still in its swaddling clothes.

What of electric cooking, of electric refrigeration and of refixturing in these "saturated" cities? Every reader knows that little more than a beginning has been made in the large-scale intensive development of such business. Some have done better than others, but on the whole the use of electricity in lighting, heating and cooling, whether in home or in industry, is very far indeed from the figures which will be developed within the next half decade, given a liberal policy with respect to the selection, training and compensation of salespeople, the organization of intensive business development based on the use of the most successful sales methods, and the co-operation of electrical men and women in each community on behalf of more vigorous expansion. Even in the haunts of conservatism telling progress awaits sales effort which knows how to prorate domestic budgets and to take advantage of the value of electric service as a welcome substitute for less modern methods of doing the daily tasks of home, office and factory.

Inadequate Wiring Deters Electrical Development

WIRING is a channel through which electrical progress flows. If it is not of adequate capacity, producers and consumers of electricity suffer. It matters not how many tributaries to progress there are, such as better lighting, heating appliances and labor-saving devices, the main channel—wiring—determines the ultimate rate of the flow of electrical energy through the meter. In earlier years, when the future of electricity was only a vague dream, there was some excuse for the meager wiring service which is now so obviously inadequate for raising the level of lighting to new standards based upon modern economics and new knowledge. The millions of old homes and apartments with no convenience outlets, or at best only one, are impassive but effective barriers to progress in the use of portable lamps and appliances. However, if inadequacy in wiring were confined to the structures of earlier years, one could view the future more complacently. Unfortunately, present wiring practice is too often not what it should be, notwithstanding the lessons of the past and the much clearer view of the future. When contracts are let solely on the basis of outlets, without specifications for adequate copper and service for a reasonable increase in the use of electricity, there is good cause to be disturbed. In modern factories and office buildings, ready for the better lighting which has advanced so rapidly in recent years, the already overloaded wiring is a great obstacle to progress.

Pride in electrical progress in this country is well justified, but there is no excuse for satisfaction as long as obstacles to further growth exist which can be readily removed. Wiring should not only be adequate for the highest standards in the use of electricity today, but a large factor of safety, founded upon reason and foresight, should be provided. The well-lighted interior of today will be dingy tomorrow compared with its well-lighted future neighbor. Adequate wiring will make it easier to keep in step.

Conduction Through Insulation Theory Needed

A VERY satisfactory theory for electric conduction in gases is available, but no adequate explanation is available for conduction in liquids and solids. In gaseous phenomena the movement of ions in an electric field explains the definite resistivity when the potential gradient is below a certain value which is different for each substance. As the gradient is increased a point is reached where further ionization ceases and saturation exists. No increase in voltage will secure an increase in current until the gradient reaches a magnitude where destructive breakdown occurs. The resistivity depends on the number of ions, the charge on each ion and the mobility of the ions under the electric field influences.

But in liquids and solids conduction may be electronic, colloidal or ionic, or some combination of these. All that is known is that the movement of electricity is accompanied by a movement of matter. In liquids a certain degree of knowledge exists as to the laws of conduction if the liquid is pure and homogeneous. But attempts to bring in temperature, viscosity, pressure, ionic content per unit volume, mobility of ions, atomic

and molecular structure and numerous other factors affecting conduction introduce so many variables that an empirical or experimental attack is usually preferred in arriving at a definite practical conclusion.

In solid dielectrics all the elements found in gaseous and liquid conduction are found and in addition absorption and residual charge effects. Attempts have been made to explain conduction in solids by electronic theories wherein there is little if any difference between an electron and an ion. The effect of electromagnetic radiations and of radioactive substance radiation is to cause conduction in solids by some sort of ionization, but details are missing and no adequate explanation exists.

Dielectric phenomena are thus unexplainable by a rational theory, and many years of research in liquids and solids has not brought much order. It is no wonder that engineers concerned with insulators and cables have been forced to develop these things by a cut-and-try method. Theory and rational design have been absent, but fortunately the use of a few principles and the exercise of much practical experimentation have produced very satisfactory results. It is to be hoped, however, that research workers will arrive at a fundamental knowledge of dielectric phenomena, for there is a practical economic advantage in replacing empirical methods by rational designs which use factors of safety based on exact knowledge.

Modern Artificial Lighting Reduces Overhead Costs

WITH modern electric lighting continuous operation is possible in workplaces regardless of location or type of building. Overhead expense is reduced when the building is not limited to one story and when the percentage of idleness of the plant is decreased. From various directions and in thousands of places such economies may be achieved with adequate artificial lighting. But this will not be done until lighting specialists recognize this economic aspect and bring it forcefully to the attention of industrial executives. Habit must be broken, and this can be best achieved by reinforcing theory by actual cases. For this reason the following experience will be of interest.

About a decade ago a well-known manufacturer of a delicate mechanical device built a one-story building of modern saw-tooth construction. Little attention was paid to artificial lighting, but, through habit, daylighting was provided in the most approved manner. Eventually a lighting specialist brought artificial lighting to the attention of the manager, with the result that this became one of the first well-lighted plants in the world. Production increased and there was great satisfaction with the artificial lighting. The management was impressed and began to think. Coarser operations were conducted in a five-story building having about three times the floor area that the one-story building possessed. The two plants were far apart and there would be marked economy in combining them. The poorly lighted five-story factory offered no difficulties in the way of lighting. The management already knew that artificial lighting could be made highly satisfactory and that it was dependable anywhere at any time. When all the area in this building was lighted in the most approved manner its space was used so much more efficiently that the operations in the smaller plant were moved into the larger one. Here was a reduction of more than 25 per cent in total floor space with an actual increase in total production. A one-story building of modern daylight construction was released and sold for a million dollars. Employees and management are quite satisfied. It is true that the location of the larger plant is less desirable than that of the smaller one, but good artificial lighting makes its interior as cheerful as that of any plant anywhere.

Economic Values in Telephone Cable Research

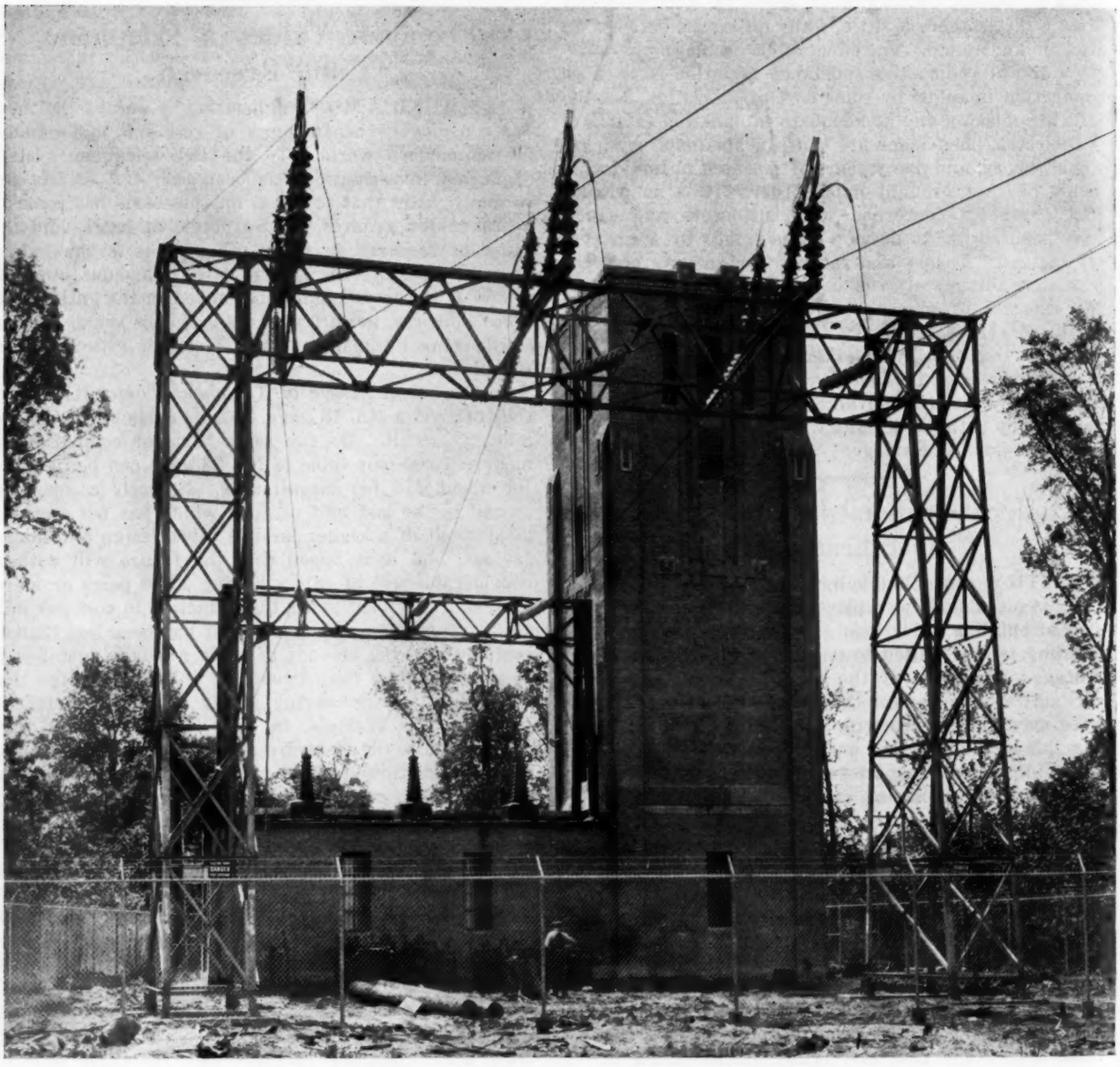
COMMUNICATION engineering is one of the most conspicuous beneficiaries of research to be found in the modern world. To the Bell telephone system organized investigation has been the staff of life for so many years that progress on this basis has come to be taken for granted by the public at large, and the cause of research in many other fields is the gainer thereby. Despite the fact that the telephone business is one of the most highly specialized in the entire electrical industry, not a few of its problems are of general engineering interest and their economic aspects are of significance.

In the current issue of *Telephone Topics* it appears that in 1888 a No. 18 gage, 50-pair cable cost $155 per mile of circuit. On the same basis of comparison a modern 1,200-pair cable of No. 24 gage can be installed for about $13 per circuit mile. Scarcely a year has passed in the last half century which has not seen the attainment of a higher level in cable design and manufacture, and it is hoped that the future will witness considerable use of cables having 1,800 pairs or more. Although in recent years the reduction in cost per mile resulting from each improvement has been less than in earlier days, the amount of cable annually installed is so much greater than twenty or thirty years ago that the present yearly saving is far in excess of former figures. For example, in 1892 20,000 miles of wire were added to the underground plant of the Bell system, but in 1926 three million miles were added. The savings made by only five of the major developments in telephone cable amounted to about $75,000,000 in accumulated first cost up to 1926.

So rapidly did the telephone business grow in its early days that the need for placing wires under ground arose before there was opportunity to perfect suitable means. Research was therefore resorted to in order to save the industry from early stunting. Long before the need for long-distance cables actually arose their development was undertaken, together with vitally important supplementary equipment. The New York-Chicago cable epitomizes the ultimate value of these developments and marks but the beginning of an extensive cable program. These improvements are significant in many ways, but their chief importance is that they mean increased service to the public. Our cities are today farther from the telephone saturation point because of wire congestion than forty years ago, since the circuit capacity of the standard underground duct has been increased per dollar of investment and per unit of area. All this means improved service and lessened delays, accompanied by lower costs to the user.

There is a parallel in the light and power industry in the development of high-voltage cable up to the present 132-kv. limit as it affects the handling of increasing loads, and in the face of such trends the economic value of engineering research should be clear to the most conservative director of appropriations.

Junction of 132-Kv. Underground Cable and Overhead Line



AT this structure are joined the 132-kv. single-conductor, oil-filled underground cables recently placed in service by the Commonwealth Edison Company and the 132-kv. overhead lines of the Public Service Company of Northern Illinois. This cable connection permits parallel operation of the Chicago system with adjacent high-voltage transmission systems without any intermediate transformation except at the Northwest generating station, where this cable terminates. Porcelain potheads serving as the terminals to the cables may be seen extending from the roof of the low structure. In the upper part of the brick tower are oil tanks which keep the interiors of the cables filled with oil. Connections and switching facilities are provided so that the Chicago system can be paralleled with the Milwaukee Electric Railway & Light Company through this cable, but ordinarily it serves only as a tie with the Public Service Company of Northern Illinois. D. W. Roper, superintendent of the street department, Commonwealth Edison Company, said on June 29: "The 132-kv. cable has been in operation about four weeks and up to the present time there have been no electrical troubles whatever with the underground cable."

Combined
Differential and Overload Protection
of 72-Kv. Bus at Long Beach Station

By Vladimir K. Yagodkin
Stone & Webster, Inc., Boston, Mass.

AUTOMATIC sectionalizing of buses may be made to serve two purposes: (1) The isolation of any faulty section of bus, and (2) the reduction of feeder circuit breaker duty in cases of excessive overloads and short circuits. The latter is especially desirable from the continuity-of-service viewpoint, as well as on account of initial and maintenance costs of circuit breakers, for it permits the heavy interrupting capacity of a few bus-sectionalizing breakers to serve a large number of feeders.

A novel differential and selective overload relay scheme which performs this dual function has been put in service recently on the 72,000-volt buses at Long Beach Steam Plant No. 2 of the Southern California Edison Company.

A short circuit or ground on a bus section or in a circuit breaker adjacent to it will cause all circuit breakers on that section to open. An excessive feeder overload or short circuit will cause the necessary bus-sectionalizing breakers to open and thereby reduce the feed-in before permitting the feeder breaker to open.

Conditions to Be Met in Protection Scheme of Long Beach Station No. 2

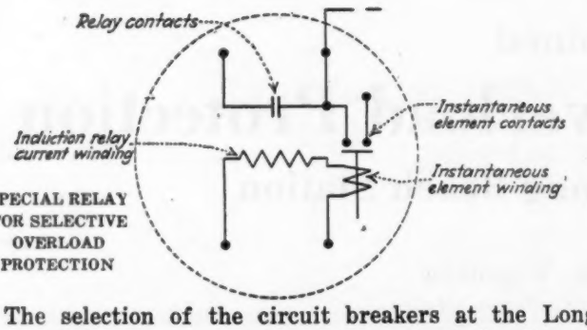
1. To have sectionalizing breaker of 72-kv. bus open ahead of feeder breaker in case fault on feeder is of sufficient severity to exceed the safe interrupting capacity of the feeder breaker.
2. Interchange of power between sections of the bus without disturbing the sectionalizing breaker.
3. Shutting down of either generator without disturbing the sectionalizing breaker.
4. With transformer breaker open, the sectionalizing breaker should open only for bus fault; feeder fault to be cleared by feeder breaker only.
5. With sectionalizing breaker open, feeder breaker should trip and function for all values of fault current.

The accompanying diagram shows the main connections of the 72-kv. buses at the Long Beach Plant No. 2. The diagram shows also the relay wiring for the west section of the lower bus, which is typical for the other sections of both upper and lower buses.

Each of the circuit breakers connected to the buses is equipped with six bushing-type current transformers. The three current transformers on the bus side of each of the feeder breakers are used solely for feeder overload protection, and those on the bus side of the transformer breakers are used for transformer differential protection. Those on the line side of all the breakers are used for bus differential protection. In the case of the bus-sectionalizing circuit breakers, the three current transformers on the side of the breaker farther from the section to be isolated are used for the differential protection of the section, so that faults in the breakers themselves will be cleared. Thus the current transformers on the east bushings of the west lower sectionalizing breaker are associated with those on the circuit breakers that are connected to the west section of the lower bus, and those on the west bushings of the same sectionalizing breaker are associated with the circuits connected to the center section of the lower bus. Necessarily, all the current transformers for differential bus protection have the same ratio regardless of the capacity of the circuit in which they are connected.

The differential protection of the bus is accomplished by an application of Kirchhoff's law, viz.: In a network, the sum of all the currents flowing to a junction point equals zero, provided currents flowing away from the point are treated as negative currents flowing toward it. When no grounds or short circuits exist, the algebraic sum of the currents flowing to any section of bus in all the conductors connected to one of its phases is zero, and the algebraic sum of the corresponding currents in the secondaries of equal-ratio current transformers in the respective conductors will likewise be zero. A ground or short circuit on the bus establishes an extra path not equipped with a current transformer, and then the sum of the current transformer secondary currents is no longer zero.

Following this principle, the secondaries of all the current transformers on the line side (or distant) bushings of all the circuit breakers, that are connected to each bus section and including the adjacent bus sectionalizing breakers, are so connected together that the algebraic sum of their currents passes through suitable relays. In the present case induction-type relays are employed and are designated "CO Diff. Relays—West Lower," etc. These relays may be set to trip all the circuit breakers connected to this section of bus in response to any predetermined minimum value of ground or short-circuit current in any of the three phases.



SPECIAL RELAY FOR SELECTIVE OVERLOAD PROTECTION

The selection of the circuit breakers at the Long Beach Plant No. 2 was based on a short-circuit current analysis of the entire Southern California Edison system, considering all generators and synchronous condensers operating simultaneously. Accordingly, the time settings of the 72-kv. bus differential relays correspond to the safe interrupting capacity of the sectionalizing breakers.

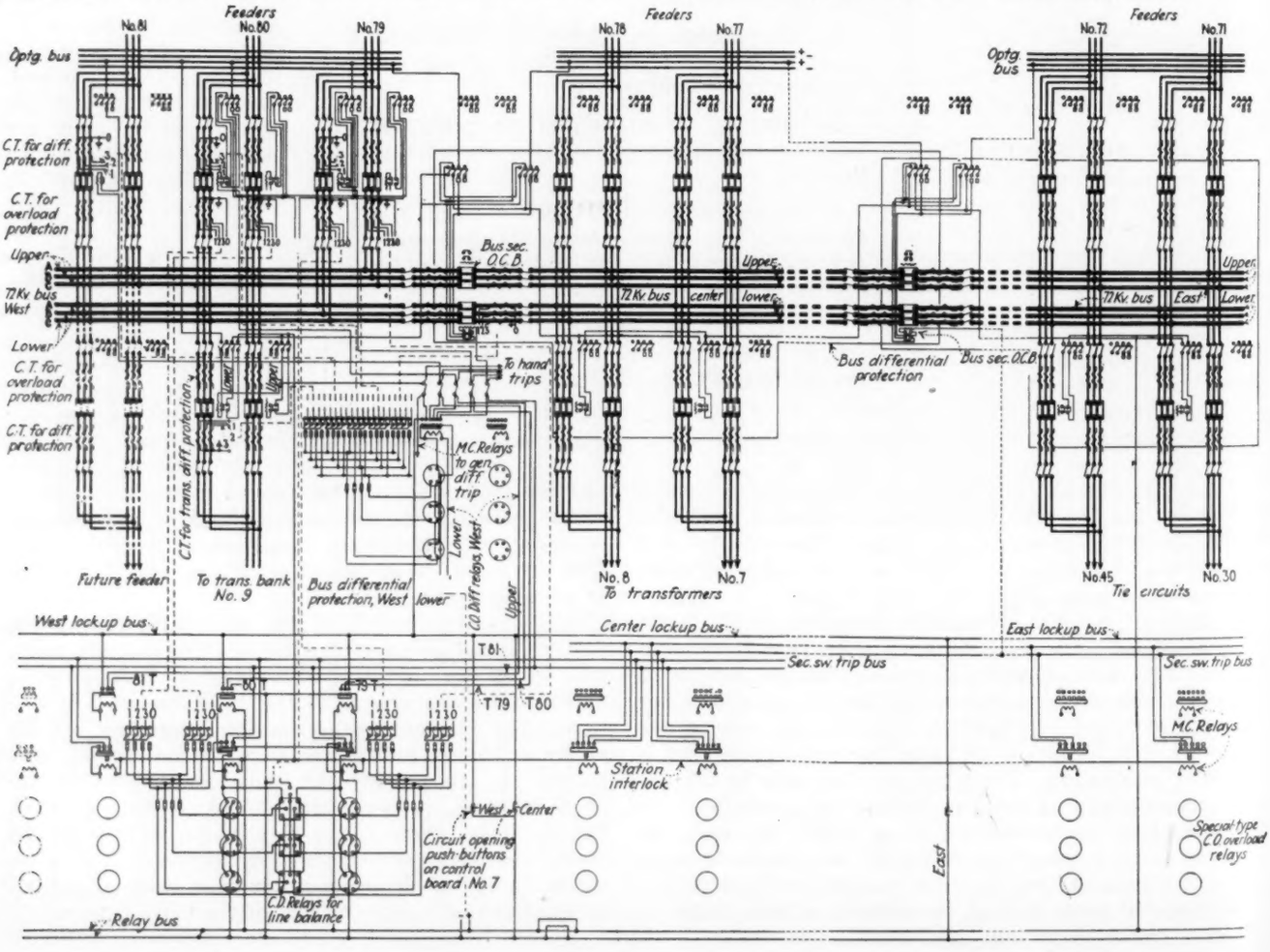
It is to be noted that the differential bus protection permits interchange of power and current of any magnitudes and in either direction between adjacent sections of a bus. This removes the limitations that exist if overload relays are simply applied to the sectionalizing breakers themselves. Furthermore, in the present scheme no differential relay actuating current is produced by ordinary switching operations, hence the operator does not have to bother with any auxiliary control circuits whenever he cuts in or out a generator, transformer or feeder.

Each of the 72-kv. feeders is provided with induction type, inverse-time-limit overload relays, which function in the usual manner unless the overload or short-circuit current is too large to be interrupted by the feeder breaker itself. In the latter event the breaker trip circuit is automatically locked open by selective relay protection until the feed-in is sufficiently reduced by the opening of bus-sectionalizing breakers.

The selective overload protection is accomplished through the addition of an instantaneous element and corresponding contacts in each of the feeder overload relays. Both the ordinary and special windings and their contacts are shown, and these relays are designated "Special Type CO Overload Relays" in the lower right-hand corner of the diagram.

This special instantaneous element in the relay is calibrated and set to close only if the feeder overload or short-circuit current is greater than the interrupting capacity of the feeder breaker. When the contacts of the special instantaneous element close, they energize an auxiliary relay, designated "MC Relay." The "break" contacts of the auxiliary relay then open the feeder breaker tripping circuits, and its "make" contacts close the tripping circuits of the sectionalizing breakers on the bus section to which the faulty feeder is connected. As soon as the proper bus-sectionalizing breakers have opened the auxiliary relay is automatically released and the feeder overload relay element proceeds to trip the breakers on the faulty feeder.

Both the east and the west sectionalizing breakers will open in case of a fault on a feeder connected to a center bus section, but only the east or west sectionalizing breaker will open in case of a fault on a feeder connected to an east or west bus section respectively.



RIVETS ENTIRELY ELIMINATED IN THIS BUILDING BY ARC-WELDED JOINTS

Data and Observation on

Arc Welding a 790-Ton Steel Structure

One and a Quarter Million Cubic-Foot Building at Sharon, Pa., Field Welded at $4.90 Per Ton, or 45 Cents Per Weld-Foot, and Erected in Five Weeks—Factors Affecting Training of Welders—Methods Used—Analysis of Data

By A. M. Candy

Engineer Arc-Welding Engineering Department, Westinghouse Electric & Manufacturing Company

ARC-WELDED joints supplanted rivets entirely in the structural-steel building recently erected at the Sharon (Pa.) works of the Westinghouse Electric & Manufacturing Company. Although this building is not the first to be arc welded, it is by far the largest structure yet produced by the arc-weld method, requiring more than four miles of shop welding, more than one and one-half miles of field welding and a total of about 17,000 lb. of welding wire. The structure, which measures 70 ft. wide by 220 ft. long by approximately 80 ft. high from foundation to the roof members, required 790 tons of structural shapes.

Field erection was handled by one crew and a locomotive crane. It was commenced on Oct. 29, 1926, and the last of the 790 tons was in place exactly five weeks later. In other words, it was erected at the rate of 158

TABLE I—ANALYSIS OF SHOP FABRICATION DATA

Part	Number	Weight Each	Weight Complete	Welding Man-Hours Shaft	Welding Man-Hours Details	Welding Man-Hours Total	Welding Linear Inches Shaft	Welding Linear Inches Detail	Welding Linear Inches Total	Lb. of Welding Wire Total	Lb. of Welding Wire Per Man-Hour
Crane girder columns	22	4,952	108,953	781½	247½	1,029	28,798	4,840	33,638	1,850	1.8
Plate and angle columns	82	.....	154,973	1,224½	451	1,675½	53,234	8,777	62,011	3,330	2.0
Spandrel beams	167	.....	183,041	.....	....	825½	.....	.....	37,300*	1,290	1.56
Nine-ton plate girders	22	17,500	383,867	.....	....	1,921	.....	.....	75,380	3,635	1.9
			830,834			5,451			208,329	10,105	
Grand total, including unclassified items						6,794			240,000	11,700	

Grand total kilowatt-hours	26,400
Cost per gross ton of steel in building	$7.16
Cost per foot of weld	0.28

Based on labor at 60 cents per hour.
Based on power at 2 cents per kilowatt-hour.
Based on welding wire at 8 cents per pound.

POWER, WIRE AND LABOR COST PER NET TON

Crane girder columns	$15.60
Plate and angle columns	18.30
Spandrel beams	7.18
Nine-ton plate girders	18.38

* Spandrel beams welded with ⅜-in. fillet welds. All others welded with ¼-in. fillet welds.

tons a week, or 29 tons a working day. The rate at which the field erection progressed was one of the greatest surprises of the entire operation. Due to the design for structural continuity and the nature of the 22 nine-ton girders, the weight of the steel in this building was reduced to 790 tons, compared with 885 tons, which would have been required by the best riveted design for the same floor loads. This represents a saving of about 11 per cent. The large nine-ton plate girders were designed for arc welding by employing plates alone for flanges and web stiffeners. This reduced the weight from eleven tons required for riveted practice to nine tons, which gives a saving in steel of 18 per cent.

One of the incidental benefits of the construction is that the structure was much easier to paint than a riveted structure, due to the absence of rivet heads. This factor, due to better paint jobs, will prove of great assistance in eliminating corrosion.

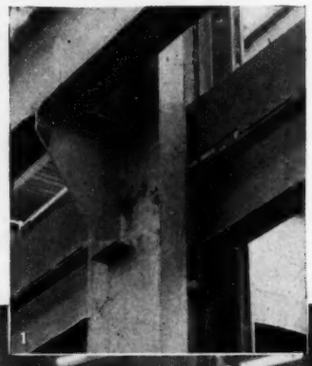
TABLE II—EXPERIENCE WITH FIELD WELDING

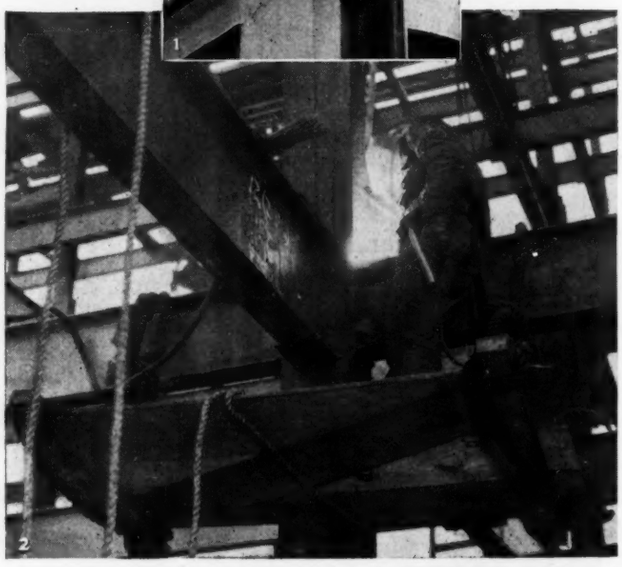
Date	Number of Men Welding	Welding Man-Hours	Inches Total	Inches Welded per Man
November 2	3	24	471	157
3	3	24	421	140
4	3	24	443	148
5	4	32	629	154
6	4	16	415	104
8	6	48	1,049	175
9	Rain	Rain	.....	...
10	5	40	641	128
11	5	40	720	144
12	5	40	954	191
13	4	16	404	101
516 lb. of wire and 1,425 kw.-hr. used.			Average....	144
15	4	32	1,010	253
16	4	32	1,186	297
17	6	48	1,864	311
18	6	48	1,260	210
19	4	32	954	238
20	4	16	510	127
22	7	56	2,088	299
23	9	72	2,570	286
24	9	72	2,782	309
25	10	80	3,151	315
26	11	88	1,607	148
27	10	40	1,557	156
1,134 lb. of wire, and 2,510 kw.-hr. used.			Average....	245
November 29	12	96	4,155	347
30	12	96	3,452	288
December 1	12	96	3,800	317
2	11	88	4,515	410
3	13	104	4,340	334
4	12	48	4,175	348
6	14	112	1,202	86
7	12	96	4,730	394
8	12	96	5,050	420
9	13	104	5,565	428
10	13	104	5,567	428
11	13	72	2,875	221
1,990 lb. of wire and 4,380 kw.-hr. used.			Average....	335
13	12	96	4,955	382
14	13	104	4,955	414
15	13	104	5,100	392
16	5	40	2,000	400
17	11	88	5,055	465
18	8	32	1,700	213
20	5	40	2,000	400
21	3	24	1,180	393
22	1	8	300	300
1,300 lb. of wire and 2,860 kw.-hr. used.			Average.....	373
			Grand average.	274

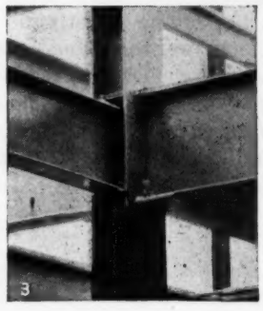
Grand total	2,568 welding man-hours and 103,257 welded inches
Grand total	4,940 lb. wire
Grand total	10,950 kw.-hr.
Grand average	1.94 lb. of wire per man-hour
Grand average	2.22 kw.-hr. per pound of wire
Cost per ton of steel welded	$4.90
Cost per foot of weld	0.45
Based on labor at	1.25 per hour
Based on power at	0.02 per kw.-hr.
Based on welding wire at	0.08 per lb.

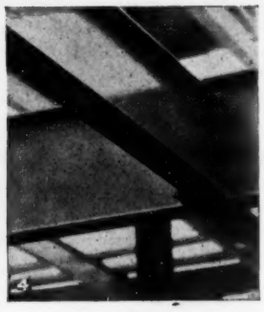
TABLE III—DATA KEPT FOR ANALYZING GIRDER WELDING DATA

	Operators				
	A	B	C	D	Averages
Energy delivered by generator per hour when there are no interruptions except for changing electrodes (kw.-hr.)	3.4	3.72	3.15	3.748	3.505
Part of time used in changing electrodes (per cent)	26	21.7	28.4	28.8	26.2
Part of time during which the generator is deilvering current when no interruption except changing electrodes (per cent)	74.0	78.3	71.6	71.2	73.75
Energy delivered per hour by generator on average (kw.-hr.)	2.85	3.15	2.624	3.108	2.933
Part of time during which the generator on average is delivering current (per cent)	62	66.3	59.6	59.2	61.8
Energy required to run the set during the time no welding is being done (kw.-hr.)	0.285	0.253	0.303	0.306	0.287
Energy received from the line while current is actually being used (kw.-hr.)	5.75	6.17	5.3	6.475	5.924
Energy actually taken from the line per hour (kw.-hr.)	6.035	6.423	5.603	6.781	6.21









SOME TYPICAL WELDED JOINTS AND WELDING PLATFORM

No. 1—Crane-rail supporting bracket welded to welded column. Made from 15-in. I-beam arc welded to crane column face. The plate-and-angle columns and crane girder columns were made up of four angles for flanges and a web plate, instead of three plates following the rational design of the nine-ton plate girders. As a result about double the amount of welding was required on these members.

No. 2—Platform for welding operators.

No. 3—Column connections and continuity plates above floor beams. Continuity of girders through the columns was obtained by "continuity plates" welded to the inside faces of the column flanges, in the plane of the top flanges of the girders. The seat angles for the beams framing into the column webs sufficed for continuity of the lower flanges of the girders through the columns.

Several factors contributed to make the cost of this particular undertaking appreciably higher than that of future projects. In the first place arc welding on a production basis was an entirely new venture in the fabricating shop. It was necessary to develop not only welders but methods of laying out the work to keep contractional stresses from distorting the shapes. Jigs and fixtures had to be developed for handling the detailed parts expeditiously. As a result the tonnage produced during the last few weeks was appreciably greater than during the first few weeks. It is not surprising, therefore, that the completed steel structure cost almost 10 per cent more than if it had been fabricated and erected by standardized riveted practice. For those desiring data for cost estimating, Table I gives data which apply to the principal members entering into the fabrication work. In this table the total man-hours is shown as 5,451. An analysis of the figures shows that if the columns had been made of plates like the girders, about 1,000 man-hours would have been saved, or about 37 per cent less than the actual man-hours and welding wire which was used.

No difficulties were encountered in erecting the steel, inasmuch as provision was made for bolting all members together the same as for riveted construction. A very decided increase in the amount of welding per man-hour was obtained as the work progressed.

Pertinent field-welding data are given in Table II By perusal of the column "Inches Welded Per Man" it will be observed that the average for first two weeks is 144; second two weeks 245, a gain of 70 per cent; third two weeks 335, a gain of 135 per cent over the first period; fourth two weeks 373, a gain of 159 per cent over the first period. This increased production is due to two causes. First, the trained men were getting more experienced and skilled in their new work of welding. Second, on and after Nov. 23 a group of professional welders were put on the job, so that almost exactly 50 per cent of the welders were men with considerable previous welding experience. It is not unreasonable, therefore, to say that for estimating a future project the figures of the third period would be much more reasonable as a basis than the total over-all averages.

Provision for structural continuity necessitated considerable extra welding that may be omitted in future work except for certain connections that do not entail much additional welding, such as the roof beams in this structure or roof purlins in other designs. In this work a strap across the connection gives the desired results except that the strap or bar should be about 1 in. narrower than the beam flange to provide for downward welding. Wherever possible, the designs were made to eliminate overhead welding, which practice, the author believes, all designers should follow. Because of the circumstances surrounding the shop fabrication future shop work should show reasonable savings. Actual field work cost almost exactly the same as though riveted and the increased production obtained as the job progressed indicates that future field work will show appreciable savings.

Advantages of Arc-Welded Structure

***1. Complete fixation can be obtained easily at all connections with weld metal (connection will weigh from 10 to 50 per cent of the standard riveted connections).**

***2. Complete continuity of lines of girder and beams can be obtained through the connections permitting the use of smaller members in many cases.**

3. Arc-welded structures are much more rigid, which should minimize the amount of wind bracing required in tall structures.

4. Painting is facilitated due to absence of rivet heads, which helps to minimize corrosion

5. Where the structure is exposed to the elements, all overlapping members can be entirely sealed by weld metal, thereby materially assisting in prevention of corrosion.

6. Changes in or additions to existing structures (either riveted or welded) can usually be made by arc welding at a decided cost saving.

7. Arc welding is practically noiseless, which would give this process preference over riveting, especially for field erection in congested business districts, etc.

*These two items were responsible for more than half of the 11 per cent saving of steel weight in the Sharon Building.

TABLE IV—WELDING PERFORMANCE ON NINE-TON GIRDER

Man-hours to weld nine-ton girder	32.000
Kilowatt-hours from line to weld one girder	198.720
Cost of power per girder (at 2 cents per kilowatt-hour)	3.970
Length of weld metal per pound metal, inches	20.500
Length of weld metal per nine-ton girder, inches	3,025.000
Weight of weld metal per girder, pounds	147.500
Weight of weld metal laid down per man per hour, pounds	4.600
Kilowatt-hour per lb. weld metal	1.348
Inches of weld per minute	1.570
*Cost per foot of weld (½-in. fillet)	$0.140
*Cost per ton, including spotting	$6.470

* Labor at 60 cents per hour. Wire at 8 cents per pound.

Procedure in Spotting and Welding

Spotting Process—Chalk mark on it the location of the edge of the web plate and where the welds are to be. Place the web plate in position and tack, using such dogs as are necessary to hold it in position. Place web stiffeners in position and tack, spotting corresponding plates on each side of web at the same time.

Place the top plate on table. Chalk mark location of the web and the places where the welds are to be. This is best done by means of a chalk line and a straightedge indicating where the welds are to be marked.

Turn the part of girder already spotted over onto the top plate in such position that the web plate edge will coincide with the marking on top plate as it lies on table. Tack in this position. Transfer girder to welding trestles. Weld this part of girder.

Place top cover plate in position and clamp, taking care that it is pressed tightly upon the top plate.

Weld cover plate to top plate.

Repeat process for bottom cover plate.

Welding Process—Plate girder as spotted in normal position. Weld web to bottom plate. Reverse position of girder. Weld web plate to top plate. Place girder on side. Weld web stiffener plates to web plates. Reverse position of girder. Weld web stiffener plates to web plate. Place girder in normal position. Spot top cover plate, using rather heavy tack welds. Weld top cover plate to top plate. Reverse position of girder and repeat for bottom cover plate.

Use ⅞ diameter electrodes.

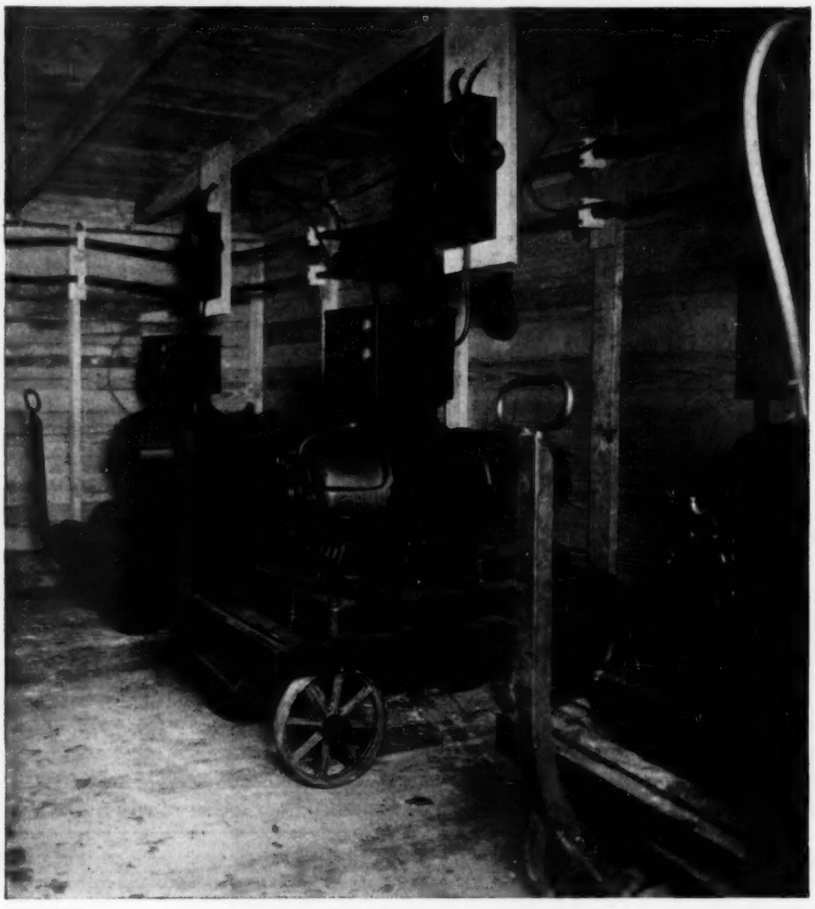
Use 200 to 210 amp. of current.

Use 18 to 20 volts across arc.

Make all welds in the downward position.

Work men in pairs welding corresponding joints on opposite sides of girder simultaneously, thereby equalizing any stresses set up by cooling, which might have a tendency to warp girder.

No small amount of courage was displayed by the American Bridge Company in accepting this contract, considering that the company had never before handled such a job. To carry out the construction of this building first consideration was given to obtaining welders. To this end several men were sent from the American Bridge Company's plant to the arc-welding school of the Westinghouse company. After a number of weeks of intensive training these men were transferred to the Ambridge plant, where the shop fabrication of the steel was commenced on Aug. 2 with about four men actually welding and a number of others in training on scrap shapes under the instruction of the welding supervisor.



SOME OF THE WELDING MACHINES USED

Finally a force of sixteen welders was trained, each man receiving from three to six weeks' instruction (depending upon ability) before being allowed to do productive work. The entire shop fabrication was completed by Nov. 1.

Recognizing the inadvisability and impracticability of attempting to use shop men as field welders, it was deemed advisable to train regular bridgemen (field riveters) to do the field-welding work. To handle this situation, the Westinghouse company established a welding school in a building adjoining the site for the new building. Corrugated sheet-iron booths were provided for ten students. To supply power, a total of three 200-amp. single-operator sets, one 500-amp. and one 1,000-amp. constant-potential, 60-volt sets with welding circuit panels were provided near by.

The training of both shop and field welders were under the supervision of a Westinghouse representative, who also acted in the capacity of supervisor and inspector for all field welding on the building. Training of operators in the school was started on Sept. 29, 1926. Fifteen men in all were trained, none of whom was put on erection welding with less than fourteen days' instruction and most of them received from twenty to thirty days' instruction.

Field welding was started on Nov. 2, 1926, with three men. This force was gradually increased to a maximum of fourteen men by Dec. 6 and the field welding was completed on Dec. 22, 1926, or in exactly seven weeks, using approximately 2,500 welding man-hours. To expedite the work during the latter few weeks of the field erection a crew of professional welders was hired. Each one was made to prove his ability by welding samples before being allowed on the structure.

The field welding was started with three single-operator, 200-amp. machines located in a small frame inclosure on the ground floor of the building. Seven welding panels were also located in this building and received power from the 1,000-amp., 60-volt, constant-potential motor-generator situated just south of the new building. This provided a total of ten welding circuits.

On Nov. 26 six additional 200-amp. machines were installed in another small frame shed that was also

EXAMPLE OF METHOD USED IN COMPUTING VALUES FROM CURRENT GRAPHS MADE DURING TESTS

Data (Taken on nine-ton girder top cover plate):

200 = amperes used.
23 = generator voltage.
2 in. = speed of meter per minute.
$1\frac{3}{8}$ in. = height of curve when using 200 amp.
0.75 kw. = power required to run the set idle—that is, no load loss.
49.5 per cent = efficiency of the welding set when delivering 200 amp.
12 per cent = part of time during which the welder rests, changes position, etc. (changing electrodes not included).

Solution:

11.38 sq.in. = average area of curves in several 12 in. sections of graphs as determined by planimeter.
$12 \times 1\frac{3}{8} = 15.375$, number of square inches representing power if it had been delivered at 200 amp. and 23 volts without interruption.
$11.38 \div 15.375 = 0.74$, part of area representing power delivered by generator when no interruptions except changing electrodes.
$(200 \times 23 \times 1) \div 100 = 4.6$, number of kilowatt-hours delivered by generator per hour if full current had been used without interruption.
$4.6 \times 0.74 = 3.4$, number of kilowatt-hours delivered by generator per hour when no interruptions except for changing electrodes.
$0.26 + 0.12 = 0.38$, part of time during which the generator is not delivering current.
$1.00 - 0.38 = 0.62$, part of time during which generator is delivering current.
$0.62 \times 4.6 = 2.85$, number of kilowatt-hours delivered per hour by generator.
$2.85 \div 0.495 = 5.75$, number of kilowatt-hours received per hour from supply line while the generator is actually delivering current.
$0.38 \times 0.750 = 0.285$, number of kilowatt-hours taken from the line to run the set during the time the generator is not delivering current.
$5.75 + 0.285 = 6.035$, number of kilowatt-hours actually taken from line per hour.

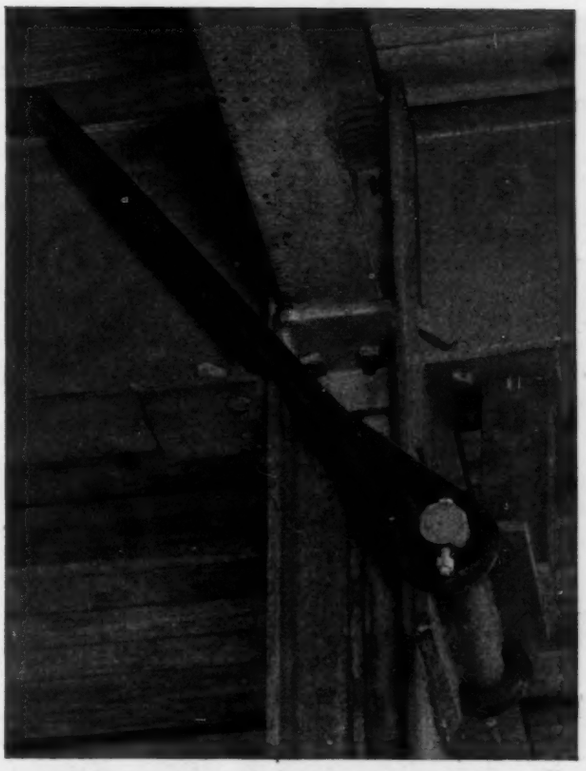
Referring to Table III it will be observed that the number of kilowatt-hours taken from the line per hour under average welding conditions, allowing 12 per cent of time for rests, is 6.21.

on the ground floor of the building. This provided for a total of sixteen welders.

The ground leads of all the machines were connected to a common cable, which in turn was connected to one of the column base plates. This connection proved ample and permanent for the entire job. The only cable run up on the structure therefore was an individual cable for each operator from his particular welding machine or circuit. The handling of these cables was no more troublesome than the equivalent air hose required for field riveting. Furthermore, the electrode holder handled by the operator has only a fraction of the weight of a rivet gun.

Assembly and tack welding of the members in position, commonly called spotting, required one foreman welder, two welders and two helpers, with the assistance of a crane for about seven hours per girder. This does not include spotting the top and bottom cover plates, which were spotted after the remainder of the welding was completed.

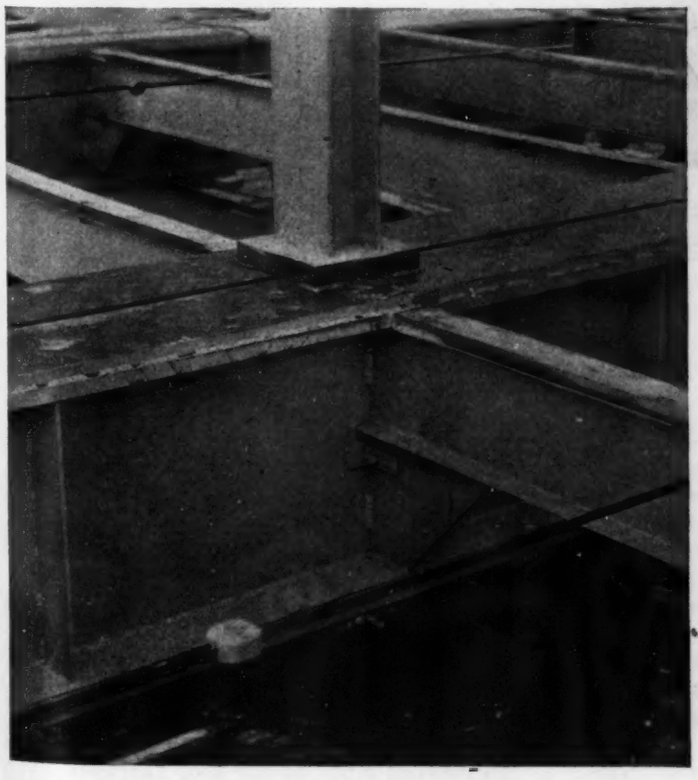
The table on which the spotting was done consisted of a series of bending slabs 5x5 ft. square mounted in a row on suitable supports to make the top perfectly level. The bending slabs consisted of extra heavy cast-iron plates having numerous perforations about 1¼ in. square. Dogs with tapered legs made of 1¼-in. round steel bent to form a right angle were used to hold the members in position while they were being tack welded. One leg of the dog was driven into a perforation in the top of the table, while the other leg pressed down on the girder member, holding it securely.



DURING FIELD ERECTION ¾-IN. BOLTS WERE USED THROUGH BOTTOM FLANGES OF GIRDERS AND SEAT ANGLES

ANALYSIS OF DATA KEPT DURING CONSTRUCTION

Graphic ammeter curves were taken for one complete girder. Four welders worked on this girder, each man doing exactly one-fourth of the welding. They worked in pairs, each member of a pair welding corresponding joints on each side of the girder simultaneously. A graphic ammeter was hooked into each man's welding circuit and a record made of the value on the curve which corresponded to the welder's full-load current.



METHOD OF FRAMING FLOOR BEAMS INTO NINE-TON PLATE GIRDERS

CONSTRUCTION OF LENTEL BEAMS TO MEET WELDING REQUIREMENTS

The generator voltage and speed of the meter were also noted at the same time.

With the data thus obtained it was possible to determine the rate of using power. Representative sections of the curves for each man's welding were chosen and his rate of using power during periods of no interruptions (except changing electrodes) was computed (see Table III). In calculations of the percentage of time that each generator delivered current it was assumed that the time spent by welders for rest, changing positions, etc., was 12 per cent of the day. On piece work this time would be materially less.

From 3,200 to 3,300 in. of weld was required on each girder. Assuming that 1 in. out of each 12 was placed there during the spotting operation, there must be 275 in. of tack welds on each girder. This leaves about 3,025 in. of weld for welders. It required 32 man-hours to weld this 3,025 in. The average hourly rate per man was therefore 94.5 in., or almost 8 ft. per hour. This is 1.57 in. per minute, which is excellent speed for this kind of welding.

Since it required 32 man-hours to weld one nine-ton girder, the energy to complete one girder was therefore 198.72 kw.-hr., according to the preceding method of analysis. Figuring the cost per kilowatt-hour at 2 cents, the power required to weld one of the nine-ton girders was $3.97.

The length of weld per pound of weld metal was determined to be 20½ in. on this kind of work. Since there was 3,025 in. of weld on each girder, the weight of weld metal per girder, not counting spot welds, must be 147.5 lb. If in 32 hours 147.5 lb. of weld metal is laid down, the weld metal laid down per hour will be 4.6 lb.

This study does not include the total elapsed time required to handle the 22 girders, and therefore the cost figures are somewhat lower than shown by the shop fabrication welding analysis table.

ACKNOWLEDGMENT

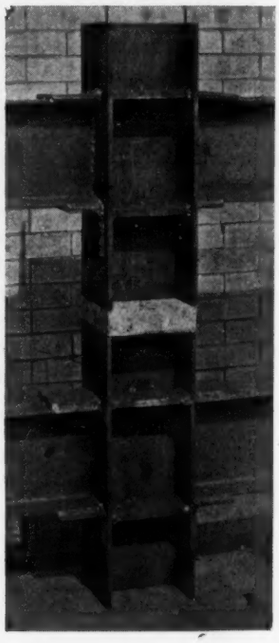
This building was produced from architects' drawings prepared by the Bernard H. Prack Company of Pittsburgh, Pa., the detailed design* being prepared by Gilbert D. Fish, consulting structural engineer, co-operating with the author on detailed welding engineering. The entire project was made possible by the foresight and guidance of W. S. Rugg, vice-president of the engineering department of the Westinghouse Electric & Manufacturing Company. All shop fabrication and field erection work were executed by the American Bridge Company.

The author wishes to acknowledge the assistance of Marshall Williams, assistant general operating manager of the American Bridge Company, in providing the figures for compiling the cost analysis tables herein included. Also the assistance of C. T. Eakin of the material and process engineering department, Westinghouse Electric & Manufacturing Company, for the preparation of the detailed study of the shop fabrication of the nine-ton plate girders.

*Engineering News-Record, Jan. 20, 1927.

NINE-TON GIRDERS AND CRANE-RAIL BRACKETS IN WHICH ARC WELDING WAS PROMINENT

No angles were employed in the fabrication of the girders. The web is a ⅜-in. by 33-in. by 45-ft. 6-in. plate. The main top and bottom flange plates are 1⅜ in. by 16½ in. by 45 ft. 6 in. The top and bottom cover plates are 1⅛ in. by 15½ in. by 22 ft. 6 in. Likewise the web stiffeners are ⅜-in. plate. A riveted girder of equivalent strength and rigidity would have weighed more than eleven tons.



9-IN. I-BEAMS JOINED TO 8-IN. H-COLUMNS SHOWING CONTINUITY PLATES

In the upper beam the continuity plate measures ⅝x3x6⅜ in. and the top plates ⅞x4x5 in. In the lower beam the top plates are ½x4x4½ in. The column weighs 32 lb. per foot, the upper beam 20.5 lb. per foot, and the lower beam 21.8 lb. per foot.

9-IN. I-BEAMS JOINED TO 15-IN. I-BEAMS WITH TOP TIE PLATE

The 9-in. beams weigh 21.8 lb. per foot and the 15-in. beams 42.9 lb. per foot. The tie plate measures ½ in. by 5 in. by 1 ft. 10 in.

WOMEN EMPLOYEES RECEIVING INSTRUCTION AT WESTINGHOUSE DEPARTMENT OF HOME ECONOMICS

Home Service an Aid to Public Utilities

By Mrs. Ella W. Smethers

General Director Home Service Department,
Ohio Public Service Company, Cleveland, Ohio

BY CONSTANTLY bringing before the public new methods in homemaking and encouraging thought and a wider exchange of ideas on homemaking problems among women a great deal of good may be done in and for any community and will materially better the public relations of a utility company.

Until recent years there has been very little progress or exchange of ideas in the proper management of the home. Homemaking has been based on the tradition of "what was good enough for grandmother will do for me." Because the competitive element was lacking, too little thought has been given to the home and its many perplexities. It is a fair question to ask how long an industrial plant could operate at a profit were it managed and operated on the same scale, using the same equipment in its factory, employing the same means of selling its product as it did even 25 years ago?

Surveys made by individual operating companies and by the National Electric Light Association show that a surprisingly large percentage of homes are being run on practically the same basis as were the homes of our grandmothers. Homes, generally speaking, are still poorly lighted, although much progress has been made in correcting this condition within the past few years. The back-breaking method of doing the family wash by means of the old-fashioned tub and washboard is still being followed in thousands of American homes. Electric sweepers and the electric iron are practically unknown in many communities.

Obligation of the Utility

It is the duty of the central-station industry to assist in alleviating this condition. Closer contact with customers and an interchange of educational information regarding homemaking problems have been found to be most productive methods of bringing home management to a par with industrial life.

For this work the women employees of our public utilities are proving to be the most valuable connecting link between the individual housewives and the service companies. Women talk in women's language, they think with a woman's mind and they know what a woman likes. This makes it possible for the women of the industry to work for and with women customers.

How an application of these principles has worked out in actual practice may be seen in the experience of the Ohio Public Service Company. In each of the company's divisions a home service department has been established in charge of a local home service director, who, together with a general director in the executive offices of the company, plans and carries on the activities of the department.

It is the purpose of this department to create a new channel of thought in homemaking through contact between the women customers and women employees of the company. It is an effort to put housekeeping on a business basis. The homemaker, although not faced with competition, can make the business of managing her home just as interesting and attractive as is her husband's business.

TRAINING EMPLOYEES

Since the spring of 1924 educational work has been carried on by the women employees of the Ohio Public Service Company with the aim of preparing themselves to conduct this home service department.

A copy of the employees' manual published by the National Electric Light Association, to which had been added a chapter relating directly to the operations of the Ohio Public Service Company, was furnished to each employee of the company. Each month the girls were assembled to discuss and study the contents of this manual, as well as other subjects related to the electrical industry. For the most part the girls themselves prepared and read papers or made talks at these meetings, and occasionally an executive or department head of the company was asked to take part in the meeting.

A study of the construction and uses of various household electrical appliances constituted an important part of these meetings, and demonstrations were given by the girls showing the operation of each appliance.

A public speaking contest formed the nucleus of the second year's study. Talks were prepared on any subject relating to the utility industry, and the knowledge and experience gained in the preparation and delivery of these talks have been found to be extremely valuable in our home service work.

Through the co-operation of the Westinghouse company ten Ohio Public Service Company women employees, one representing each division of the company, completed a special course conducted by the department of home economics of the Westinghouse company at its Mansfield (Ohio) works. This course covered not only a study of each of the smaller electric appliances but also a thorough training in the construction and operation of the electric range. In the model kitchen maintained at the Westinghouse plant are installed six electric ranges, and the girls were instructed in the intricacies of the culinary art and became practical and efficient operators of electrical cooking equipment. In addition to studying the details of the public utility business and the electrical equipment used in the home, this educational work included interior decoration, dietetics, serving of meals and the general subject of homemaking.

In starting this work the most difficult task confronting these home service directors was the method of announcing their service and getting their information across to the public without danger of having their purpose misinterpreted as a purely commercial proposition.

With the assistance of the executives of the company, a series of afternoon customer teas were given. In some of the divisions invitations were sent out by the girls to the officers only of local clubs. Others extended invitations to the presidents of the clubs, asking them to include those of their members who would be interested in attending the tea. In other instances the members of civic, welfare or church societies were invited.

At each tea a short talk was given by either the local or the general director welcoming the guests and announcement was made of the facilities available through the home service department. E. R. Treverton of the Ohio Public Service Company, Cleveland, and Earle W. Hodges, director of public relations of Henry L. Doherty & Company, were also present at each tea and explained the purpose of the newly organized home service department and stressed the fact that, although the company aims to make a profit on all of its activities, it does not let the dollar eclipse the desire to render real service to its communities. These short talks were followed by a brief musical program or possibly a dance and always the serving of tea and electrically prepared refreshments.

Although the invitations to these teas were received with a great deal of curiosity and much apprehension, the fact that approximately 75 per cent of the housewives to whom invitations had been issued were present was encouraging, and the enthusiasm with which the establishment of the home service department was received was extremely gratifying.

ELECTRICAL COOKING SCHOOLS

Recently a series of electrical cooking schools was conducted by home service departments, and the attendance was large and enthusiastic. A home economics expert was secured for one week to conduct each of these schools. Monday was spent in preparation for the school; Tuesday was devoted to a class composed entirely of the domestic science classes of the local high schools, and on Wednesday, Thursday and Friday the general public was invited, allowing Saturday on which to send out recipes and other household hints which the visitors at the electrical cooking schools had asked for.

In one of the smaller towns served by the company it was found that the attendance on the third or last day was more than triple that of the first day, and every one who attended the first class was present at the two following classes.

In one division a follow-up on the sale of electrical appliances has been worked out. The local home economist accompanies the appliance salesman on his call to the customer. If a sale is made, she then calls upon the customer within a few days to inquire if the appliance is working properly, to instruct in its proper use and to give whatever service may be necessary to keep the customer satisfied.

In another division the local home economist prepares luncheon menus for small club gatherings, the hostess of course providing the food and the home service department merely preparing it for serving. There is no question that this has been very beneficial as an advertisement for the home service department and the company. New recipes are always being sought by the average homemaker, and in many cases new salad recipes or table hints appropriate to a coming holiday are being furnished through the columns of the local newspapers.

Much of the success of the Ohio Public Service Company's home service department must be attributed to the support received from the company's executives, who have given their full co-operation and placed in the department those employees who are sincere in their purpose and who have the utility's interest at heart at all times. Of equal importance is the appreciation by the department's personnel of the tremendous amount of work that must be done and their responsibility in building better public relations for the company.

Excess Peak Responsibility vs. Demand in Cost Studies

Favors Consumption and Excess Demand Method of Cost Allocation—Consumption and Excess Peak Responsibility Applicable Chiefly to Large Customers

By W. J. Greene

Rate Engineer Iowa Railway & Light Company, Cedar Rapids, Iowa

REFERRING to the two very fine articles by W. H. Hills in your issues of Jan. 22 and 29, the writer wishes to take exceptions to a number of his statements and claims. Under his discussion of my method, in the first article, he considers whether net kilowatt-hour switchboard output or the kilowatt-hours generated should be used. The question is no more essential to the writer's method than to any other. Mr. Hills sets up an example that he claims proves the inaccuracy of my method.

Whatever method of cost allocation is used, there will always be special conditions to meet. For example, shall allocations be made just before a power plant is enlarged and when the surplus peak capacity is a minimum, just after the enlargement and when the surplus peak capacity is a maximum, or at a time representative of average conditions? If the last-mentioned time is accepted as the fair basis, the actual costs for any other period over which the allocation is to be made must be adjusted to give representative average capacity cost conditions. A change in station unit peak costs or change in load factor referred to station peak will cause a shifting of costs with any method involving consumption, demand or peak responsibility.

TABLE I—COMPONENT COSTS OF SERVICE WORKED OUT BY THREE METHODS

	Consumption and Demand Method			Consumption and Excess Demand Method			Consumption and Excess Peak Responsibility Method		
	Consumption Portion	Demand Portion	Total	Consumption Portion	Excess Demand Portion	Total	Consumption Portion	Excess Peak Responsibility Portion	Total
A	$2,534	$19,595	$22,129	$4,167	$17,961	$22,129	$4,167	$30,208	$34,375
B	7,601	15,676	23,277	12,500	10,777	23,277	12,500	18,125	30,625
C	6,081	3,919	10,000	10,000	.....	10,000	10,000	.....	10,000
D	12,669	9,796	22,465	20,833	1,632	22,465	20,833	.....	20,833
E	2,534	19,595	22,129	4,167	17,962	22,129	4,167	.....	4,167
	$31,419	$68,581	$100,000	$51,667	$48,333	$100,000	$51,667	$48,333	$100,000

A little study of Mr. Hills' example will show a set-up involving most unusual conditions. A 20,000-kw. maximum demand, 20,000-kw. peak load and 20,000-kw. generating unit are added to a 100,000-kw. plant having, presumably, a 20,000-kw. protective reserve, with increment unit costs the same as the unit costs of the original plant. Under normal conditions the unit increment costs should not have exceeded $37.50 per kilowatt, or $750,000 for the unit. The Greene method would have allocated $765,000 to the added system, and the Greene-Schoonmaker-Gorton method (adopted by this company in 1920 for special systems and which is the same as Mr. Hills' "phantom customer" method) would have allocated $1,125,000 to the new system. Greene's method or theories apparently give more equitable results for that condition.

It is regrettable that Mr. Hills overlooked the modified peak responsibility method described in the second of a series of three articles by W. J. Greene, C. F. Schoonmaker and C. B. Gorton, published in your issues as follows: "Cost of Electric Service," page 878, Oct. 21, 1922; "Allocation of Electric Service Costs," page 928, Oct. 28, 1922; "Handling Cost Elements in Fixing Rates," page 1431, Dec. 30, 1922, and also described in an article, "Allocation of Capacity Costs," by the writer, in your May 29, 1926, issue, page 1192, and designated "peak responsibility and average hourly load" method. The method is the same as Mr. Hills' "phantom customer" method. The Eisenmenger method was given careful consideration at the time of adopting the Greene-Schoonmaker-Gorton method, but the latter method was considered more simple and accurate.

The Greene-Schoonmaker-Gorton method was incorporated in a "Manual for the Determination of Unit Costs of Electric Service" and copyrighted in 1922 by the Iowa Railway & Light Company. This method is identical in principle and results with the "phantom customer" method given by Mr. Hills. What he terms "phantom customer" we termed "unused period capacity." Mr. Hills apportions the "used period capacity" costs by the consumption (kilowatt-hour or energy) ratios and adds to such costs the "phantom customer" costs allocated by the excess peak responsibility ratios. He finds the kilowatt adjusted demand or period capacity requirements of each system by dividing the allocated costs by the station unit peak cost. In our method the kilowatts of "used period capacity" are allocated by the consumption ratios. The kilowatts of "unused period capacity," or Mr. Hills' "phantom customer" capacity, are allocated by the excess peak responsi-

bility ratios. The combined results give the kilowatt adjusted demand or period capacity. The capacity costs are then allocated by the adjusted demand or period capacity ratios.

The Greene-Schoonmaker-Gorton method has for more than six years been a matter of monthly routine in our accounting department and has proved satisfactory where there is no radical shifting in the systems forming the peak responsibility loads. The errors or inconsistencies due to the shifting of peak responsibilities, inherent in the straight peak responsibility method, are still there, only to a lesser degree. Mr. Hills states for this method that it seems to be simple, fair and practical. Our experience is that the method is simple and practical only for use in allocating capacity costs to the systems of a power plant where there is not much shifting in peak responsibilities. Where several power plants are interconnected by a transmission system and it is desired to allocate the combined capacity costs of all the power plants and connecting transmission system (the transmission system being considered as an extended switchboard bus) the method becomes complicated, costly and impracticable.

To clear up nomenclature in the future discussion, the writer's first method, the "consumption and demand" method (described in ELECTRICAL WORLD Nov. 7, 1925, page 947) appears to be properly designated. His second method (described in ELECTRICAL WORLD May 29, 1926, page 1190, and which Mr. Hills overlooked), heretofore called the "used and unused capacity" method, might be more accurately designated the "consumption and excess demand" method. The Greene-Schoonmaker-Gorton method, or Mr. Hills' "phantom customer" method, which are identical, might be quite accurately designated the "consumption and excess peak responsibility" method.

SOLUTION AVAILABLE IN EITHER METHOD

The writer is confident that the solution of the problem of allocating capacity costs will be found in either Greene's method or the Greene-Schoonmaker-Gorton method, or a combination of them. He doubts whether any other acceptable method can be developed that will give results differing from one or the other of those methods. The choice between the "consumption and demand" method and the "consumption and excess demand" method is solely one of convenience in application. The "consumption and demand" method is clearly the more simple for application of allocated unit costs to rates, since the demands are used directly without the complication of obtaining the excess demands. The use of the "consumption and excess peak responsibility" method is applicable only to special conditions, such as was represented by the example set up by Mr. Hills in attempting to prove the "consumption and demand" method in error.

Table I shows the three methods with the component costs worked out on the data used by Mr. Hills in his article that appeared in your issue of Jan. 29. Decimals are carried to a point where errors are kept under one dollar, which explains the difference between the values shown therein and Mr. Hills' values. Table II shows the load data. These data are submitted with the belief that they will clarify the problem. Assume that for one year A and B customers formed the group of excess peak responsibilities and the next year E and B customers formed that group. It is found by an examination of Table I that a shifting of $736,992 a year between A to E would take place on a 20,000-kw. maximum demand. Please bear in mind this shifting may occur frequently, yet Mr. Hills condemns the "consumption and demand" method because it causes a shifting of $380,000 for a 20,000-kw. maximum demand under a condition that will rarely, if ever, occur.

It is evident that if the A and E customers were alternating as "on" and "off" peak, and the interval of times between such alternations were the same, both should be allocated the same costs. On the "consumption and excess peak responsibility" method each load would then be charged with $19,271. The "consumption and excess demand" method allocates $22,129 to each. Which is the more equitable allocation and why should the B customer, who does not have another customer with whom to divide costs, be so penalized for such accidental conditions?

TABLE II—LOAD CONDITIONS APPLYING TO CASES STUDIED

	Kilowatt Demand	Peak Responsibility	Average Load	Excess Demand	Excess Peak Responsibility	Unused Period Capacity Allocated by the Excess Demand Ratios	Unused Period Capacity Allocated by the Excess Peak Responsibility Ratios	Adjusted Demands by the Consumption and Excess Demand Method	Adjusted Demands by the Consumption and Excess Peak Responsibility Method
A	10,000	10,000	833.3	9,166.7	9,166.7	3,592.3	6,041.7	4,425.6	6,875.0
B	8,000	8,000	2,500.0	5,500.0	5,500.0	2,155.5	3,625.0	4,655.5	6,125.0
C	2,000	2,000	2,000.0	0.0	0.0	0.0	0.0	2,000.0	2,000.0
D	5,000	0	4,166.7	833.3	0.0	326.6	0.0	4,493.3	4,166.7
E	10,000	0	833.3	9,166.7	0.0	3,592.3	0.0	4,425.6	833.3
	35,000	20,000	10,333.3	24,666.7	14,666.7	9,666.7	9,666.7	20,000.0	20,000.0

Unused Period Capacity = 20,000 — 10,333.3 = 9,666.7

It is evident that no convincing arguments can be raised against both Mr. Hills' and the writer's contentions that "used period capacity" costs should be allocated by the consumption ratios. The controversy will be between the use of the "excess demand" and "excess peak responsibility" ratios for the allocation of the "unused period capacity" costs. Those advocating the use of the "consumption and excess peak responsibility" method must consider whether the claimed greater equity of the method is sufficient to offset the increase in the consumer cost of applying it over the cost of applying the other methods.

The writer reproduces two paragraphs from his article that appeared in your issue of May 29, with insertions included in the brackets:

> One very serious objection to the peak responsibility method [this refers also to the "consumption and peak responsibility" method], not mentioned by Mr. Knight or Mr. Snow, is the cost of applying the method for general use. This would bar the method for such use, even if it were accurate and possessed none of the other objections.
>
> Yet, with all its objectionable features, the writer is not ready to abandon the use of peak responsibility with modifications [for example, the "consumption and excess peak responsibility" method] for certain purposes. One

use is for allocating boiler or steam plant investments and capacity costs to electric and steam systems (such as district heating system) and for allocating investments and capacity costs of an electric plant to the electric systems served directly from the switchboard. The other use is for large consumers who cannot be served as a group but who can arrange a major portion of their loads to come at off-peak times.

Since those paragraphs were written the number of uses for the "consumption and excess peak responsibility" method have, in the writer's opinion, become more restricted. He is not ready to abandon the method entirely but believes the ultimate decision of a majority of those responsible for the allocation of capacity costs will be in favor of the "consumption and excess demand" method or its counterpart, the "consumption and demand" method, and that the use of the "consumption and excess peak responsibility" method will be applied only to those large consumers whose major loads can be so controlled as to improve station load factor.

Today's Science and Tomorrow's Engineering*

WITH the work of Maxwell and Hertz in the eighties it seemed probable that all the great discoveries had been made. Quite the contrary. A generation ago science accepted the boundaries of our stellar universe and the boundaries of the atom. Today astronomers know that our universe is only one of myriad similar universes, while physicists know that the atom is a miniature planetary system. Probably, in the last analysis, matter and energy are one. Certain of the phenomena of radiation, such as the photoelectric effect, are inconsistent with the wave theory. The atoms are not indivisible, nor the elements immutable. The radioactive elements are spontaneously disrupting their atoms and changing into other elements. The Newtonian dynamics fail when dealing with velocities approaching that of light or with microscopic quantities of energy such as the angular momentum of an electron.

Can it be possible that electrical engineering—based as it is on the fundamentals of physics—will remain substantially unchanged while the fundamentals are undergoing profound modification? It seems highly improbable.

Already the electron tube is creeping into the power field, for communications and control. Carrier-current telephony, remote control of substations and of street lighting, voltage regulation, synchronizing, telemetering, feeder protection are some of the functions that tubes are now performing or are about to perform on transmission systems. Already the electric light and power company engineer must familiarize himself with the electron tube.

The tubes are steadily growing in size and capacity. They give promise not merely of controlling but of transmitting power in bulk. High-voltage tubes have been built to operate successfully on 500,000 volts. High-current tubes have passed as high as 600 amp. Were it possible to combine both capacities in one tube, there would result a rating of 300,000 kva. Such a combination is now and may always be impracticable, but we should not have to go beyond 1 per cent of that rating to have a real power tube, and there is no visible insuperable obstacle in the way of such a development.

When such a stage is reached, the logical function of the electron tube in power transmission would seem to be as a transformer from alternating current to direct current and back again. But before that time comes, and many years of development must pass before it arrives, other and newer discoveries may bring earlier and more sweeping changes.

With the development of the high-power cathode-ray tube we have a new tool of undetermined possibilities but of tremendous power. Conceivably large new industries utilizing cathode rays may add a novel and considerable load to electric light and power company lines. The therapeutic value of ultra-violet is fast gaining recognition by the medical profession. The time may come when every family will have an ultra-violet lamp.

But there are other results that have been obtained with ultra violet, and more recently with cathode rays, which suggest the possibility of a still more novel and extensive use of electric energy. Food lacking in the vitamine necessary for the prevention of rickets may be made anti-rachitic by exposing to either ultra-violet or cathode rays. What is true of this one vitamine may prove true of the others. Electrical energy, instead of playing the minor rôle it now is in agriculture, may become the chief agent in feeding the world.

All these prospective developments can bring only gain to the electrical industry, but before any of them arrive another sort of advance may occur. Our best lamps have an efficiency of only about 4 per cent in terms of the ideal light or of about 8 per cent in terms of luminous radiation. Surely such an economic waste cannot long endure. We have no exact conception of the mechanism by which a ray of light is originated, but we do know that it is somehow produced when an electron hops from one orbit to another in its atom, and we know with reasonable certainty what kind of hop produces what kind of ray. The problem, then, of producing a lamp of ten or twenty times the light efficiency of the present "Mazda" lamp is to learn how to direct our electrical energy so as to make it all-effective in causing the right kind of electrons to make the right kind of hop. And there is nothing essentially hopeless in such a problem. Free electrons in a vacuum have been brought under absolute control.

If this result were achieved over night, which is improbable, a temporary reduction in revenue would be inevitable, but surely the history of the "Mazda" lamp, with its quadrupling of lighting efficiency, shows that the reduction would be only temporary. If it be true that science is advancing at a swifter rate than ever before, that advances in science inevitably bring unexpected and sometimes almost lightning-like changes in engineering and in the industries based on engineering, is there nothing for industry to do but wait expectantly to see where the lightning will strike? I think it has been sufficiently proved that American industry can organize effectively for research, and I believe industry generally is awaking to the need for such organization. What is chiefly lacking today is men—men capable of leadership in research—men with broad scientific training, with initiative, courage and resourcefulness, and above all with the passion for truth and for the extension of knowledge. Such men are the driving force of successful research, the inspiration and guide of their fellow workers. Our industrial progress will in the end depend on research.

*Abstract of address by L. A. Hawkins, engineer of the research laboratory of the General Electric Company, Schenectady, N. Y., before the N.E.L.A. convention at Atlantic City, N. J., June 7, 1927.

Letters from Our Readers

Asks Sage Advice on Three Subjects

To the Editor of the ELECTRICAL WORLD:

As a younger member of the industry may I use your worthy publication to ask that some gray-haired reader, higher in authority and longer in service, answer a few questions which have been put to me by various persons inside and outside the industry. Let me first of all square myself in order that you may understand that I come with humble heart seeking knowledge, not to ask questions to which I have in my own mind the sinister answer or which I ask only to make some one uncomfortable. I hold no brief for any one in particular, including myself. I am myself satisfied at present with my lot in life and am a perfectly free agent to change it at any time.

Last month I attended the first official college reunion of my class. The college is technical and stands as one of the leaders in the field. Here I met my old professor of electrical engineering, a man with some reputation both as a research and practical engineer. When he found that I was connected with the central-station business, he made the following remark: "If the folks now attending the N.E.L.A. convention in Atlantic City would stop trying to break their wrists patting themselves on the back, they might realize that the greater part of their success is due to research and would, therefore, give credit where it belongs and use their influence toward making the general public realize of what vital necessity research is to them." I suppose he had just returned from an unsuccessful conference with his superior in which he endeavored to have a portion of the meager research fund set aside for work he desired to do.

Curiously enough, I heard the same day that one large manufacturer, devoting much money to research, was in a rather disadvantageous commercial position in relation to the smaller manufacturers, owing to the heavy research overhead expense with which their small motors were charged. True as this may be, I have not heard this company complain on this score. It is true that large concerns have made money on the equipment developed by their research departments by charging for patented apparatus a price large enough to carry the development expense on other equipment. They have made a great deal of money and paid good dividends. There is no harm in this. Surely a man or concern should be compensated for the faith he or it has placed in a venture, especially when this faith is backed by cold cash. Nevertheless, is research receiving the financial help it should receive? Should not the public, through the central-station "good-will" advertising, be made to realize more fully the benefits it derives from research to the extent that more men will give freely of their worldly goods to this worthy cause?

Another question of more human interest arises. In this year's report of the public policy committee of the N.E.L.A. I find the following: "And then we urge consideration for those upon whom the operation of our vast, intricate enterprises depends. Loyalty and performance we have a right to expect, but we must in turn practice loyalty also. The laborer is worthy of his hire and of something more, and we should see to it that we have not only enterprising and efficient employees but happy and contented ones as well, who glory in the day's work, confident in the belief that the rewards will not be withheld."

From this I turn to the May 15, 1927, Harvard Business Alumni Association *Bulletin*, page 144, last table, entitled "General Averages," and find that public utility employees stand particularly the lowest on the list of all industries, including even teaching, in rates of compensation to employees. "Verily they have their reward." The work is fascinating. Every day brings new problems for those full of life and the desire to create and not to fall into some soft job involving mere routine employment. But is this the answer? Should not the employee receive compensation commensurable with the duty he performs, no matter how fascinating the work?

Accompanying this report is this rather facetious letter from the friend who sent it: "The inclosed booklet of the Harvard Business School Alumni Association strikingly but, I fear, ineffectually points out the way in which budding geniuses in the public utility industry are ridden and discouraged by the public which they endeavor to serve and are kept on a strictly bread and oleomargarine diet by the check upon expenses continually maintained by the public service commission established by the aforementioned public."

This, while undoubtedly written only in a jovial mood, carries with it a possible explanation. Are the public utilities because of their fear of public criticism afraid to charge a price for their service sufficient to give to their employees a just reward? If so, then verily the public shall receive service commensurate with the price paid. If any one disbelieves this statement, let him look at the New York subways. The politicians playing to public favor demanded a 5-cent fare in the face of a rise in the cost of living of nearly 200 per cent. They are now receiving a 5-cent service. Let them stew in their own juice.

It might be argued that the graduates of Harvard are entering a highly technical business in which they must expect to receive less compensation while learning, but on careful thought I believe most of us will dismiss this argument, for much of the central-station business is no more technical than any of the other businesses mentioned in the report. If the substance of the Harvard report be true in fact, will the public utilities continue to draw the high-class help necessary fully and adequately to develop this greatest of American industries, or will the banker draw the young men of today into the bond business, making distributors rather than creators out of the new blood which annually flows from colleges into business?

One more question, which can be made short and requires little enlargement. Why do the majority of central-station companies persist in selling residence service on the basis of kilowatt-hours when kilowatt-hours are but 10 or 15 per cent of the total cost of rendering that service? Have those grown old in the industry lost their grip or are the younger men entering it of a caliber so much softer that they dare not come out like men and say: "The costs are so-and-so, and to render the service and to increase its usefulness to you—the public—rates for service will consist of two parts—a readiness-to-serve charge and a low kilowatt-hour charge"?

The industry has made marvelous strides in the past. It is hoped that it may continue so. If there is an adequate answer to these three questions, it will probably clear the atmosphere.

A YOUNG ENGINEER.

Central Station and Industrial Practice

Test Data on Electric Stereotype Pot

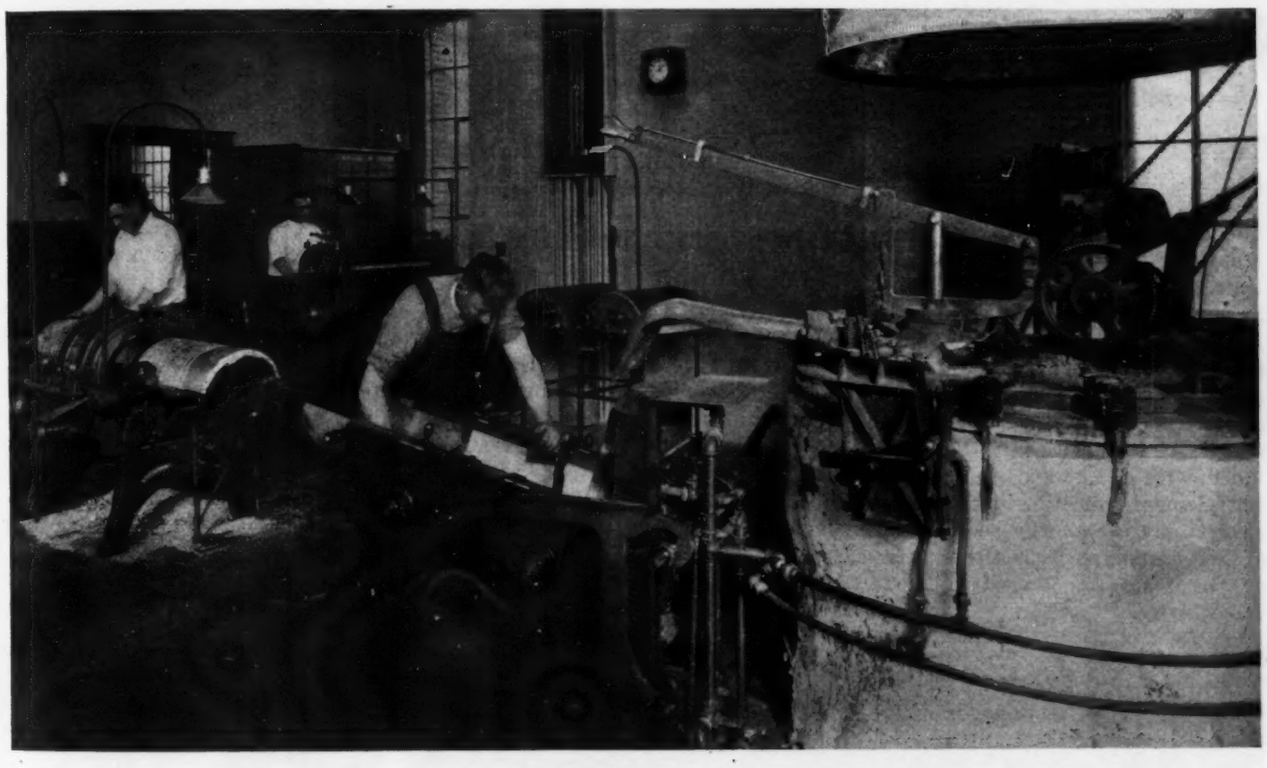
Energy Consumption, Demand, Production and Service Requirements of Melting Pot and Performance of Auxiliary Equipment Determined Through Shop Experiments

AN INTERESTING test was lately conducted on an electrically heated stereotype pot at the new plant of the Salem (Mass.) *Evening News* to determine the energy consumption, demand and service requirements of the installations. The pot is a five-ton Hoe outfit equipped with nine 6-kw., 220-volt, General Electric stereotype melting pot units, controller, panel and Bristol temperature control instruments. It was installed in January last and its use has resulted in the production of better plate type, less dross, fewer plates to be made over, decreased labor, better working conditions for the men, elimination of danger from pot cracking and excellent economy. The test extended from 6 a.m. to 3:16 p.m. and showed a total energy consumption of 234 kw.-hr. for 22,280 sixteen-page newspapers printed, or only 10.5 watt-hours per paper.

In installing the electric heating units the pot was lifted from its supporting shell, which was filled with silocel powder, leaving only sufficient room for the pot to rest securely on its supporting frame. The outside of the shell was insulated with 3 in. of 85 per cent magnesium. The stereotype metal was covered with 2 in. of asbestos wool and silocel powder, which reduced the amount of dust caused by pushing back the powder when dipping. The pot is equipped with two pumps, one of which is used for casting ingots used in linotype pots. Due to the uniformity of electric heating, burning of the combination metal used in this work has been prevented, and the plate metal is giving excellent satisfaction.

The test shows the value of the insulation method employed, and this is also brought out in daily banking. When the day's work is over and the pot is recharged for the following day's run, the energy supply is cut off at 3:45 p.m. as a rule with the temperature at 625 deg. F. No electric heating is added during the night and at 6 a.m. the temperature has fallen to but 450 deg., or a loss of but 175 deg. in fourteen hours and fifteen minutes. The temperature is brought back to 650 in one hour and 53 minutes. During the noon hour the loss does not exceed 10 deg. with the energy supply to the pot disconnected.

In the tabulated test run all metal cast and recharged into the pot was weighed. In the total period 7,095 lb. of castings was produced and the maximum demand of the pot was 52 kw., the total weight of metal charged being 7,444 lb. The pot was consuming energy during 297 min-



REMOVING STEREOTYPE FROM CASTING BOX OF ELECTRICALLY HEATED POT IN SALEM (MASS.) "EVENING NEWS" PLANT

RESULTS OF HEAT RUN ON 54-KW. STEREOTYPE POT

	Time, A.M.	Elapsed Time, Minutes		Temperature Deg. F.	Pounds of Metal Cast						Pounds of Metal Recharged							Voltage	Kilowatt Demand of Pot	Kw.-Hr. Consumption of Pot	Papers Printed
		On	Off		No. Plates 76 Lb. Each	Weight	Flat Work	Ingots	Slugs	Total	No Plates 52 Lb. Each	Weight	Tails 24 Lb. Each	Weight	Slugs	Scrap	Total				
Switch closed	6:00			450														245	52		
Temperature control	Off 7:53	113		650			82			82						779	779	243			
Agitator in	On 8:25		32	610					161	161					161	88	249				
Began casting																					
	Off 8:45	20		650	3	228	30			258			3	72			72				
	On 9:25		40	610	8	608				608			8	192			192				
	Off 9:40	15		650	5	380				380	6	312	5	120			432				
											6	312					312				
	On 10:01		21	610	3	228	10			238	6	312	3	72			384	240	50.4		
	Off 10:21	20		650	6	456				456	6	312	6	144			456				
	On 10:45		24	610																	
	Off 10:58	13		650	12	912				912	6	312	12	288			600				
	On 11:20		22	610	3	228				228	6	312	3	72			284				
Changed to low heat	11:28				1	76				76			1	24			24		17.4		
	Off 11:31	11		650							5	260					260				
	On 11:38		7	610	9	674				674			9	216			216				
Agitator off	11:43																				
Switch opened	Off 11:58 P.M.	20		620														240	50.4		
Switch closed on high heat	On 1:00		62	610												284	284			178	16,185
	Off 1:26	26		650			50	1,088		1,138						92	92				
	On 1:53		27	610			111	528		636											
	Off 2:17	24		650			24	198		222						836	836	239	50.3		
	On 2:22		5																		
Agitator started	2:37			630							24	1,248					1,248				
	Off 2:50	28		650	13	988	38			1,026			13	312			312				
	On 3:09		19	610							6	312					312				
Switch opened	3:16	7		625														240	50.4	56	6,095
Totals		297	259		63	4,778	345	1,811	161	7,095	71	3,692	63	1,512	161	2,079	7,444			234	22,280

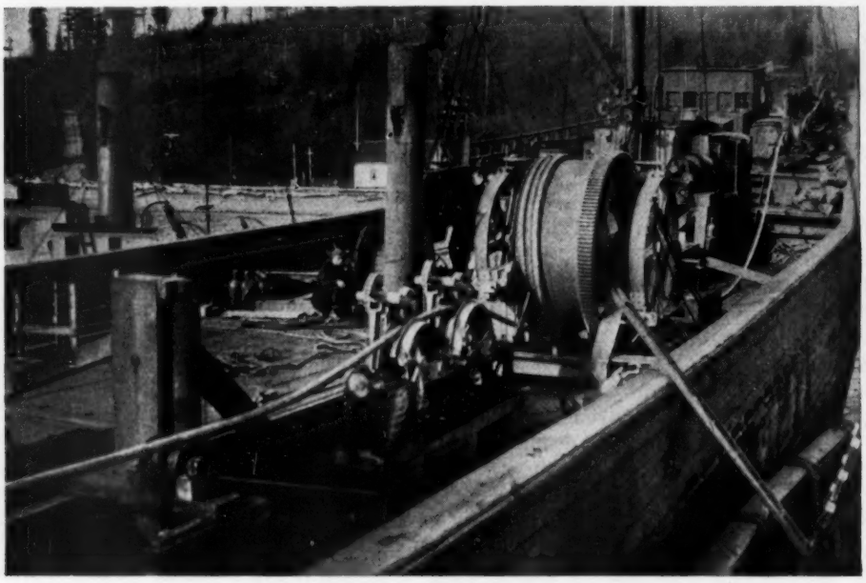
utes and was floating without energy input for 259 minutes of the total time. Energy is supplied to the Salem *Evening News* by the Salem Electric Lighting Company, and the total use of electricity in this plant earns a rate of about 2.6 cents per kilowatt-hour. Fifteen linotype machines are in service, each being provided with a 1.50-kw. electric heating element, but the test described covers only the energy requirements of the stereotype pot. Other details of the tests are presented in the table above.

Equips Ship for Submarine Cable Laying

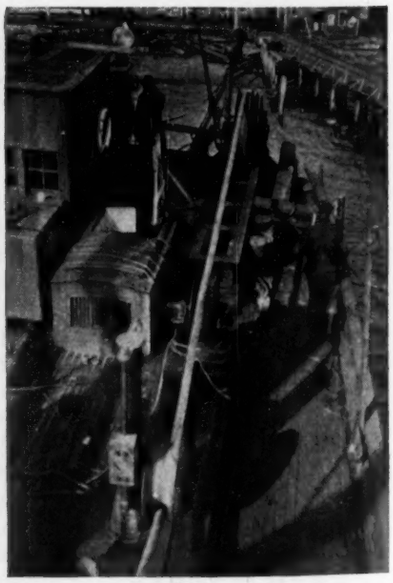
TECHNIQUE of laying deep water submarine power cables has been developed by engineers of the Puget Sound Power & Light Company to the point where laying a long cable in deep water is no longer fraught with the dangers that once attended such undertakings. In laying its latest cable across Hood's Canal, one of the waterways of Puget Sound, the cargo ship illustrated was used.

Special cable-laying equipment, consisting essentially of a 3x8-ft. cable drum geared to a donkey engine and provided with two 8-in. by 6-ft. water-cooled brake drums, was mounted on one side of the ship as shown. On the other side was located the splicing equipment and two cable tanks for storing the cable after being spliced and tested while the ship was tied to the wharf.

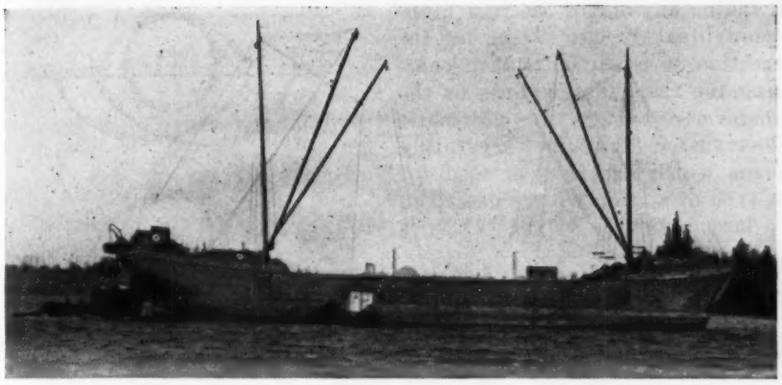
In the laying operation the route of the cable was from the cable tank through the necessary guide rolls, over a two-sheave tension carriage, around the 8-ft. drum three times,



SPECIAL CABLE-LAYING EQUIPMENT PROVIDES FOR CONTROL OVER LAYING TENSION OF SUBMARINE CABLE

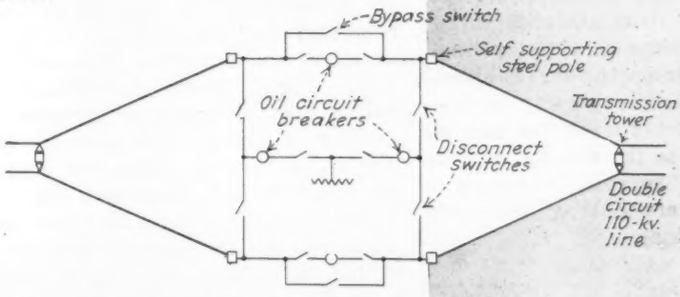


DYNAMOMETER AND GUIDE SHEAVE ON STERN OF VESSEL



CARGO SHIP CHARTERED FOR LAYING SUBMARINE CABLE IN PUGET SOUND

through a dynamometer and over sheaves into the water at the stern of the vessel. The dynamometer indicated the tension on the cable at all times and the water-cooled brakes gave perfect control over laying tension. Telephone communication was maintained at all times between the foreman's position on the stern fairway of the ship and the man at the cable drum, the captain of the tug, and to the shore over the cable.



SCHEMATIC LAYOUT OF TRANSMISSION LINE SUBSTATION

The cable was a 15,000-volt, three-conductor, No. 1/0 rubber-insulated, leadless cable approximately two miles in length and was laid in water reaching a maximum depth of 500 ft. The time required for laying was only an hour and fifteen minutes. The equipment used and the methods of laying were similar to those described on page 1122 of the Nov. 27, 1926, issue of ELECTRICAL WORLD and shown pictorially on page 394 of the Feb. 19, 1927, issue.

PRINCIPAL ADVANTAGES

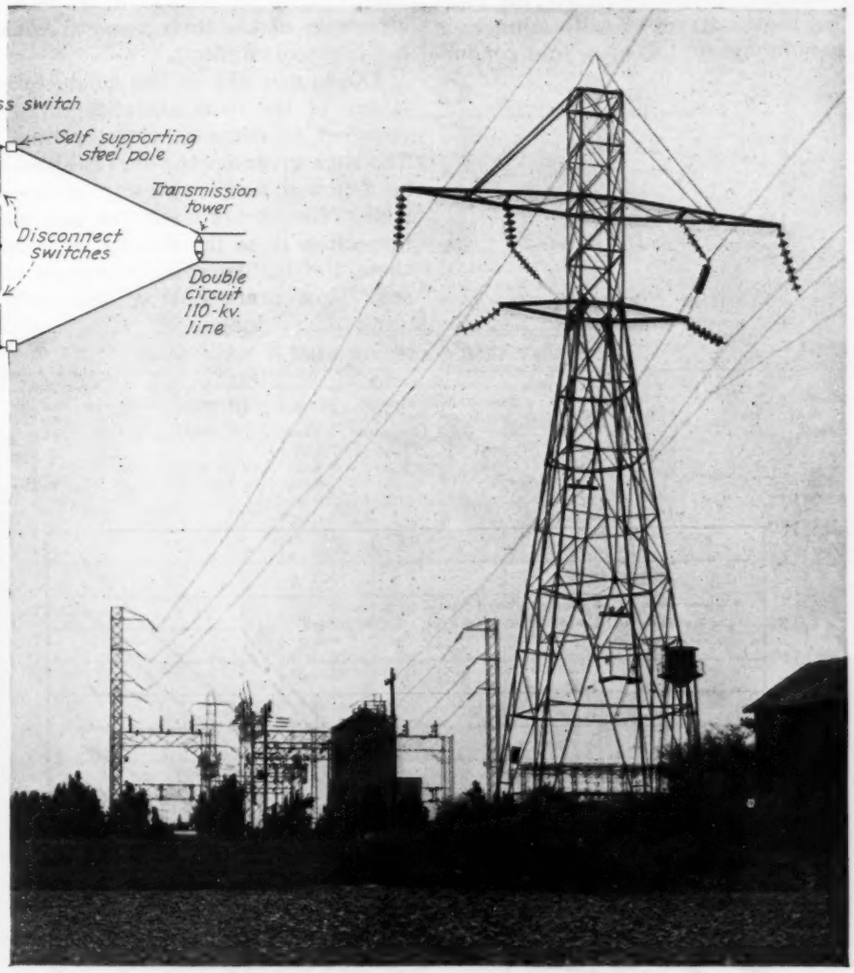
One of the principal advantages of this method of laying cable is that it is possible to hold true to the course, and experience has shown that this results in a saving of about 10 per cent in total length of cable laid. Another advantage is that there are sleeping quarters and a commissary for the accommodation of the men in case the job requires more than one day's time.

This and other cable-laying jobs of the Puget Sound Power & Light Company have been carried out under the supervision of M. T. Crawford, superintendent of distribution.

Substation Placed Midspan in Transmission Line

IN BUILDING several substations on its double-circuit, 110,000-volt transmission line the Great Western Power Company of California has found it advantageous to locate the stations on the center line of the transmission circuit and midway between towers carrying the two transmission circuits around it on steel poles as shown in the accompanying illustrations. This arrangement makes it convenient to tap both lines, simplifies structures and high-tension connections and is economical as compared with other methods.

As indicated in the single-line, high-tension wiring diagram, a double bus and switching combination is provided, which permits four possible sources of power supply to the station. Normally the station is fed from only one high-tension line, but the switching arrangement is



TRANSMISSION SUBSTATION ARRANGEMENT WHICH SIMPLIFIES HIGH-TENSION STRUCTURE AND WIRING

The substation is located in the center of the transmission line, and the two high-tension circuits are carried around it on four steel poles, two of which are shown. The transmission tower in the foreground is a transposition tower, hence the special top arm and extra insulators which are not used on the normal straightaway tower.

such that in case of trouble on that line the station may be quickly thrown over to the other line. By means of an oil circuit breaker at each end of the transformer bus the two transmission lines may be either paralleled or separated under load through an oil circuit breaker. By-pass and disconnecting switches permit taking any one of the four high-tension breakers out of service for inspection or repair without de-energizing the transmission lines or the transformer bank. An automatic line-transfer and line-separating scheme which has been devised for this type of station will be described in a later article.

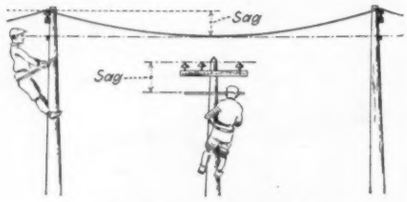
Rural-Line Specifications—IX

Of the Wisconsin Power & Light Company

Ties and Sags

A GREAT deal of operating trouble and expense can be avoided if the conductors are properly tied to the insulators when first installed. One of the drawings herewith illustrates the type of ties that are to be used and the table gives their size and length.

All aluminum conductors must be tied with aluminum tie wires only. Before tying in, the conductor must be neatly wrapped with aluminum banding wire. Copper line conductors must be tied with annealed copper tie wires.



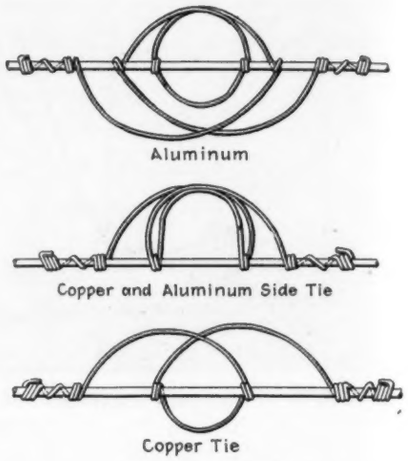
SIGHTING CONDUCTOR SAG

On straight lines the conductor is to be tied in the top groove, and at angles the conductors are to be placed in the side groove on the outside of the insulator. It is necessary that all ties be applied neatly and under tension. The ends of the tie wire are not to be cut off closer than 1 in. to the conductor, as doing otherwise makes their removal with hot line tools difficult.

The proper sag of line conductors is one of the most essential things required to make serviceable lines. The sags given on the curves should be followed as consistently as possible. No one can tell the sag by inspection from the ground without the aid of instruments. Guessing at sags is a practice that invariably leads to line trouble. A simple and accurate method of measuring the sag is by the use of targets placed on the poles as indicated in the sketch. These targets may be lath or similar strips, nailed to the pole with two nails at the proper distance below the conductor when resting on the insulator.

If a line has varying span lengths, an average span should be selected for determining the sag. It is also necessary that the sighting be done at about the center of the section being sagged. If the section is over half a mile in length or includes a number of curves, it is desirable to sag at two points which are about one-third distance from each end.

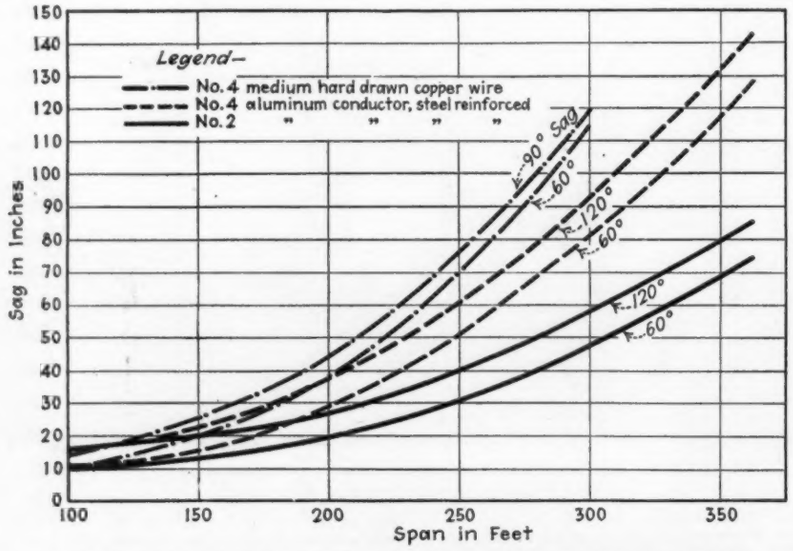
The conductors must be pulled up above the correct sag and then permitted to settle back. In no case must the tension imposed in stringing exceed the elastic limit of the conductor. No line is to be permanently dead-ended unless all conductors rest at the same sag.



INSULATOR TIES

FLAT ARMOR AND TIE WIRE

Size of Conductor	Flat Armor: Thickness (In.)	Width (In.)	Weight per 1,000 Ft.	Required per Insulator (In.)	Pounds per 100 Insulators	Tie Wire: Size	Weight per 1,000(Ft.)	Required per Tie (In.)	Pounds per 100 Ties
4 al.	0.05	0.30	17.6	35	5.15	6 al.	24.2	52	10.5
2 al.	0.05	0.30	17.6	42	6.16	6 al.	24.2	60	12.1
4 cu.	....	....	....	....	....	6 cu.	79	38	19.75
Angle tie	....	....	....	....	....	6 cu.	....	50	39.5



SAGS RECOMMENDED FOR VARIOUS CONDUCTORS WITH DIFFERENT SPANS

A 380-Kv. German Transmission Line

A TRANSMISSION line rated at 380 kv., according to report, has recently been completed between Neuenahr and Rheinua, in Germany, by the Rhenisch-Westphalian Electric Power Works Company to connect its steam and hydro-electric power stations. Actually there are two lines about 125 miles in length, each consisting of three hollow copper cables 42 mm. in diameter, supported on masts about 110 ft. high spaced at intervals of approximately 328 yd. A noteworthy feature of the work is the erection of the line across the River Rhine near Coblenz in a single span of 547 yd.

Commercial Activities and Public Relations

Customers' Graphic Record Aids Power Engineers

By H. P. Smith

Statistician Duquesne Light Company, Pittsburgh, Pa.

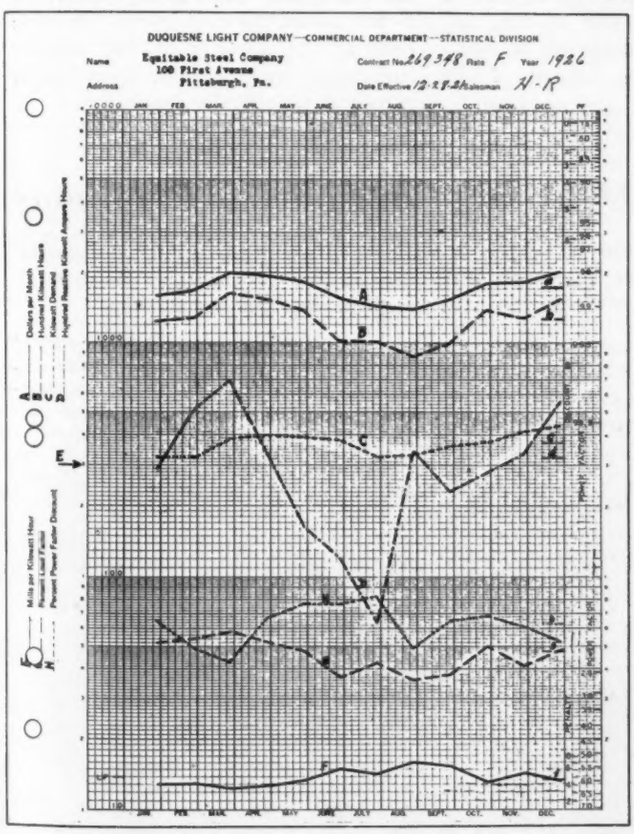
THE commercial department of the Duquesne Light Company has recently inaugurated a customers' "graphic record," which has proved to be most useful in making available all phases of each wholesale customer's requirements and rates to the power sales engineers each month.

This information enables a study to be made of ways and means of improving load factor and power factor by the addition of load. Errors can be detected in the metered demand, the consumption or the billing. It can be ascertained if the customer is on the most advantageous of optional rates, and it provides a record of a customer's growth as well as seasonal fluctuations.

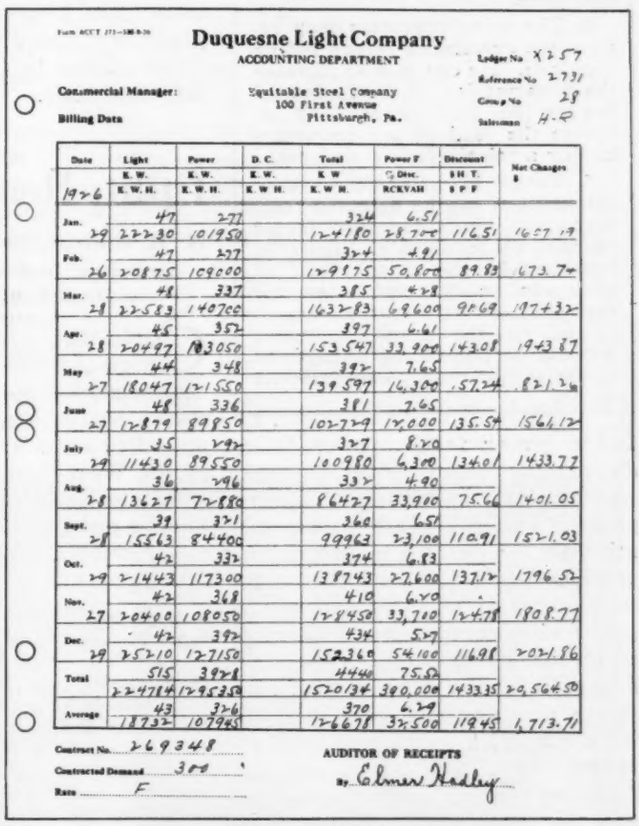
The requirements of each customer are compared monthly, and the records of customers of the same class are compared from time to time. Installations of each group that has a relatively low load factor are studied with a view to recommending more liberal use of the electrical service.

The problem of determining what records may profitably be kept is both important and difficult. Not only is it expensive to collect and compile too many data but the data may easily become so burdensome as to defeat the purpose intended. It is felt that with the plan as developed and described here a great deal of information is obtained with reasonable cost and that the data are of interest and so presented as to be readily usable. The records become more valuable as the quantity of information is increased and the period covered is lengthened.

Billing data are furnished the



TYPICAL ARRANGEMENT OF CUSTOMERS' "GRAPHIC RECORD"



Duquesne Light Company
ACCOUNTING DEPARTMENT

Commercial Manager:

Billing Data

Equitable Steel Company
100 First Avenue
Pittsburgh, Pa.

Ledger No. X257
Reference No. 2731
Group No. 28
Salesman H-R

Date	Light K.W. K.W.H.	Power K.W. K.W.H.	D.C. K.W. K.W.H.	Total K.W. K.W.H.	Power F % Disc. RCKVAH	Discount $ H.T. $ P.F.	Net Charges $
1926							
Jan. 29	47 22230	277 101950		324 124180	6.51 28700	116.51	1607.19
Feb. 26	47 20875	277 109000		324 129875	4.91 50,800	89.93	673.74
Mar. 28	48 22583	337 140700		385 163283	4.28 69600	90.69	197+32
Apr. 28	45 20497	352 133050		397 153547	6.61 33,900	143.08	1943 87
May 27	44 18047	348 121550		392 139597	7.65 16,300	157.24	821.2in
June 27	48 17879	336 89850		381 107729	7.65 17,000	135.54	1564.12
July 29	35 11430	292 89550		327 100980	8.20 6,300	134.01	1433.77
Aug. 28	36 13627	296 72880		332 86427	4.90 33,900	75.66	1401.05
Sept. 28	39 15563	321 84400		360 99963	6.51 23,100	110.91	1521.03
Oct. 29	42 21443	332 117300		374 138743	6.83 27,600	137.12	1796 52
Nov. 27	42 20400	368 108050		410 128450	6.20 33,700	124.78	1808.77
Dec. 29	42 25210	392 127150		434 152360	5.27 54100	116.98	2021.86
Total	515 227414	3928 1795358		4446 2022134	75.52 390,000	1433.35	20,564.50
Average	43 18732	326 149613		370 168678	6.29 32,500	119.45	1713.71

Contract No. 269348
Contracted Demand 300
Rate F

AUDITOR OF RECEIPTS
By Elmer Hadley

OUTLINE OF BILLING DATA SHEET KEPT

The scale for the dollars and kilowatts is shown in the first column at the left of the sheet. The same scale is used for the hundred kilowatt-hours and the reactive kilovolt-ampere-hours. The distance between the dollars per month line, *A*, and the kilowatt-hours line, *B*, represents the mills per kilowatt-hour when laid off on the vertical scale with 10 as the base. The distance between the hundred kilowatt-hour line, *B*, and the kilowatt-demand line, *C*, represents the load factor when laid off on the vertical scale with load factor as the unit. The distance between *A* and *C* gives the dollars per kilowatt per month when measured on the vertical scale at the left with 1 as the base. The distance between *B* and the hundred reactive kilovolt-ampere-hours line, *D*, represents the power factor when measured on the vertical scales at the right of the sheet with power factor as the unit. The per cent power factor discount may be determined by reading the same distance on the discount or penalty scales which are adjacent to the power factor scale. Line *F*, showing the contracted demand, is placed at the left margin at the time the graph is prepared. For the more important contracts the various quantities considered are totaled and averaged. These averages are then plotted as shown by *a*, *b*, *c* and *d*. When an exact analysis is being made of a customer's requirements where the net rate per kilowatt-hour, load factor and power factor are used, these quantities are also plotted as shown on the graph and marked *F*, *G* and *H*, respectively. The yearly averages are indicated by the short lines at the right of the sheet indicated by the small letters. Line *H* can be plotted directly from the figures shown on the billing data sheet or by taking the distance between lines *B* and *D* and determining the discount from the graph and plotting the results.

commercial department by the accounting department from the customers' bills. By plotting four items that appear on the bill, eleven factors are shown clearly on the graph. The four items that are plotted are: Net bill, consumption, demand, and reactive consumption. The seven additional values shown on the graph as a consequence are: Net rate per kilowatt-hour, net rate per kilowatt per month, load factor, power factor, power factor discount or penalty, date of meter reading, and length of the billing period. The graphs are plotted each morning for all bills mailed on the previous afternoon, and if the results show any irregularities, the power sales engineers at once make an investigation. After information has been plotted, the billing data sheets are returned to a clerk in the commercial department, who arranges the sheets by groups and holds each group until the day before the regular meter-reading date, when the sheets are forwarded to the auditor for further entries. The group number, shown on the billing data sheet, represents the expected meter-reading date.

The customers' "graphic record" is of the semi-logarithmic type with special markings for load factor, power factor, power factor discount, power factor penalty, and the time in months. It presents a wonderfully clear picture embracing all the details of the customer's power requirements. The information imparted is timely and helpful to the sales engineers, particularly as the time required to become thoroughly familiar with an individual record is but a few minutes each month.

Although the graph may be made accurate within 1 per cent, it is not intended that actual quantities be taken from it, because the billing data sheet is available except for the few days a month when in the accounting department for subsequent entries.

The value of the graph is increased for the reason that installations of practically all sizes may be plotted on the sheet as designed. In order to accommodate customers having demands of more than 10,000 kw., monthly consumptions of more than 1,000,000 kw.-hr. or net bills of more than $10,000 per month, the graph is modified by adding an additional cipher to the figures of the left-hand scale.

All of the lines for small customers lie near the bottom of the sheet, the lines for moderately large customers near the center, and those for larger customers near the top. The relation between the rate per kilowatt-hour and the load factor varies with the size of the load and consequently with the general location of the group of lines. It is to be expected that large customers pay less per kilowatt-hour than small customers when the load factors are the same in both cases. Therefore, for a given load factor, the distance between the dollars per month line and the hundred kilowatt-hours line will be less for large customers than for the small, whereas the distance between the demand lines and consumption lines will remain the same.

Because the Duquesne Light Company has optional rates, it is desirable to have the power sales engineers review the activities of the wholesale customers. Previous to the use of the customers' "graphic record" the records of the smaller customers were rarely investigated except as specifically requested.

Advantages

of readily available, complete and up-to-date billing data for all wholesale customers

1. Each salesman receives complete billing data as soon as the bill is prepared.
2. The seasonal variations for each customer are shown.
3 Characteristics of each class of service can be obtained by studying the graphs for similar contracts.
4. The sales engineers may review the customer's record before each call. He can seek to increase the consumption of the customers having low load factors, and increase the load of the customers having a relatively low demand.
5. Errors in meter readings or calculations can be detected from the graph when the load factor changes unaccountably. Similarly, mistakes in the calculations of bills can be detected when the rate per kilowatt-hour as represented on the graph fluctuates without corresponding changes in in demand or energy consumption.

Utility Head Outlines Commercial Problems

G. M. Gadsby, President of the West Penn Power Company, Foresees Revenue Increase Through Inducement Form of Rates, Rebuilt Distribution Facilities and Engineering Salesmanship

COMMERCIAL men's most important function is the intensive development of more extensive use of electric service by present consumers, according to G. M. Gadsby, president of the West Penn Power Company, who addressed remarks along this line to a group of Southeastern utility men recently. Some of his comments follow:

High load factor is of equal importance in each of the elements of a transmission and distribution system. A transmission line serving only a coal mine load at 35 per cent load factor has its dollar employed only 35 per cent of the time, and the rest of the time that particular dollar is idle. If the same circuit is used to supply a town distribution system, the dollar may be used 65 per cent of the time, and this analysis may be carried on throughout the system.

* * *

The further development of the large power and heating load will remain chiefly an engineering proposition. We have found it very much to our advantage to employ consulting engineers versed more thoroughly in a special line of industry than our own men could hope to be. Engineers of this type, if carefully chosen for their specific knowledge of the subject, bring to the prospective customer a viewpoint from outside of our industry and they should be capable of talking the language of both parties, which our own men oftentimes cannot do.

* * *

Few commercial establishments appreciate the value of good lighting as an advertising medium rather than merely a necessary adjunct to the business, such as cash registers or clerks.

* * *

Growth of revenue from domestic and commercial consumers requires three things: First, an inducement form of rate structure; second, adequate supply mains and delivery facilities; third, engineering salesmanship.

* * *

Rates were designed to secure essential revenue, regardless of use, to provide for fixed investment and customer costs which have no bearing on the quantity of energy delivered. . . . Schedules should invite the present and prospective user to equip himself for all the services electricity can perform, without at the same time assuming liability for payments which appear to him to be out of proportion to the value he is to receive. We should not expect

the consumer to have more confidence in his capacity to use kilowatt-hours than we have in the capability of electricity to perform a useful service for him. . . . Let us do away with restrictive forms and offer promotional rates.

* * *

Rapid growth in new communities or increasing demand in localities remote from original load centers has brought about the construction, block by block, of feeder mains and secondary circuits of capacity scarcely sufficient to meet present requirements, to say nothing of future load.

* * *

The development of four-wire distribution mains has been a tremendous help in overcoming limitations of increased voltage on distribution primaries. We have spent hundreds of thousands of dollars in improvement of facilities for domestic and commercial consumers, and our distribution engineering department has been able conclusively to show a satisfactory return on these expenditures by savings in maintenance and operation, reduced energy losses and increased consumption, resulting from proper voltage.

* * *

Contacts should be made with architects, contractors and builders and plans for new buildings reviewed before construction work begins. Within the past few months our commercial lighting department reviewed the plans for a new department store and found that the wiring was laid out to use a maximum of 27 kw. in lighting. After some discussion, the owner and architect agreed to changes which resulted in a wiring installation having a capacity of 139 kw., of which lighting and appliances were immediately installed requiring 100 kw., the remainder being for future enlargements. Upon completion of this building the owner wrote us expressing his gratitude for the interest displayed by our department and the results secured for him, which would never have been obtained except for our activity.

* * *

The reception generally accorded on the part of the merchants to whom improved lighting has been suggested has been amazing. It is very common to hear such expressions as: "I have known for a long time that something was wrong. I have spent thousands of dollars on store fixtures which have been ineffective because of improper lighting. If you can help me secure proper return from this investment by improving my lighting, the cost of electricity will be a negligible item." The co-operation of the fixture and electric sign manufacturer is to be had for the asking. Not only will they furnish engineering help but they will take over a part of the advertising cost, either directly or by allowing a wider spread between sale and purchase price, on assurance that proper advertising will be done by the electric company.

Field for Appliances in Sparsely Settled Areas

THE DeForest district of the Wisconsin Power & Light Company provides a striking example of the profitable field which small communities offer central stations for the sale of appliances. Although this is the company's smallest district, with only 793 residential customers, half of whom are farmers, it led all the other districts during 1926 with average sales per residential customer of $18.25, or a total of $14,466 for the year. In addition to other items, 13 electric ranges, 33 washers, 13 vacuum cleaners and 22 irons were sold to patrons in this small area. The district won the cup put up by a washing-machine manufacturer for selling the largest number of their machines per residential customer. The winning district competed with every other district, all of which were considerably larger.

Electric Trucks Aid Soap Manufacturer

A FLEET of eight five-ton Walker electric trucks and one General Vehicle truck distribute the soap products of Kirkman & Sons, Brooklyn, to the retail metropolitan stores and to the trade throughout a radius of 28 to 30 miles of New York City.

The economy effected by the substitution of the nine electrics for the 40 horses formerly used is demonstrated by the fact that only two-thirds of the number of men previously employed are now required for the operation and maintenance of the trucks and less than half the housing space is needed. In every case the chauffeurs were picked from the former teamsters.

Besides this efficient fleet of trucks, the company makes use of three electric industrial trucks to move cases of soap, soap chips and soap powders about the plant and to the loading platforms. Where previously two men were required to load a street truck, one with the help of a conveyor now does the work and with much greater ease and speed. Not only the finished product but also soda ash, grit and other raw materials used in the manufacturing process are handled by the industrial trucks.

ELECTRIC TRUCKS USED TO DISTRIBUTE SOAP PRODUCTS AND ELECTRIC INDUSTRIAL TRUCKS USED EXTENSIVELY IN SOAP MANUFACTURER'S PLANT

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Mercury-Vapor Power Plant at Hartford.—Briefly, the equipment in this plant comprises a mercury boiler fired with pulverized coal, a mercury-vapor superheater, a mercury economizer, a combustion air preheater, a mercury-vapor turbine, a heat exchanger that is at once a mercury condenser and a steam boiler, and a steam superheater through which steam passes to the steam plant in connection with which this mercury unit operates.—*Power*, May 31, 1927.

Effect of Radiant Heat on Water-Cooled Furnace Walls.—A. G. CHRISTIE.—This article provides a discussion of what happens in the water screen, water walls and first row of boiler tubes, the velocities attained and probable rates of heat absorption. In concluding, the author states that further study must be given to water levels in the drums, speed regulations, blowing down of water-cooled walls, dust removal from tube surfaces and recirculation in the side walls.—*Power*, May 31, 1927.

Tailrace Used to Obtain Test Load on Hydro-Electric Unit.—C. R. REID.—A method of eliminating the usual water box or rheostat for test loads on a large waterwheel generator is described in this article. Spacing and placement of electrodes and the supporting plan are given.—*Power*, June 14, 1927.

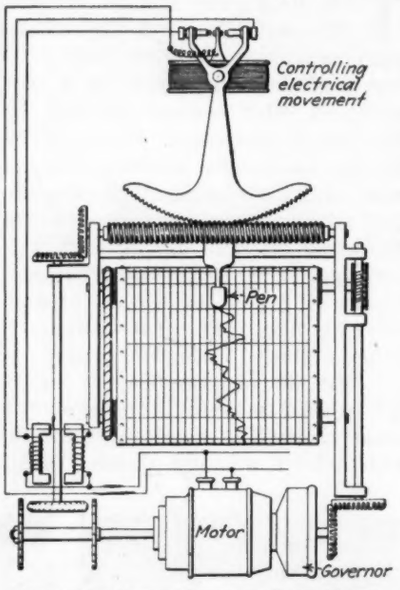
Transmission, Substations and Distribution

Latest 220,000-Volt Transmission on the Pacific Coast.—G. R. FALKNER NUTTALL.—The first section of this article, published in *World Power* for January, 1927, directed attention to the main transmission lines of the State of California and referred especially to the valley sections of the Brighton-Merced line. The present section discusses that part which is situated in mountainous country and which, for reasons explained, is not of the double-circuit type.—*World Power* (*England*), June, 1927.

Inductive Interference Between the Two Lines of a Double Three-Phase Transmission Line.—P. SCHMID.—The inductive coupling between the six conductors of a twin three-phase transmission line causes in-phase and out-of-phase electrical displacements within the systems. Instigated by actual occurrences on such twin lines in practice, the author develops a mathematical formulation of these problems which permits a close calculation of the energy transported by each wire. It is shown that the influence of external alternating-current fields upon the wire considered can be substituted for the mathematical treatment by a certain added amount of impedance. With the line data of a twin three-phase line supplying Zurich, Switzerland, as a basis, the use of the formulas is explained. The second part of this paper deals with the investigations of peculiar hunting phenomena observed on another Swiss double line of 50,000 volts. It was found that the cause of these line oscillations was inductive interference, bearing out closely the mathematical conclusions of the author, as laid down in the first part of the article.— *Bulletin de l'Association Suisse des Electriciens*, Vol. IV, 1927.

Units, Measurements and Instruments

Recent Advances in Alternating-Current Measuring Instruments. — K. EDGECOMBE and F. E. J. OCKENDEN.—The moving-iron instrument is investigated by the authors from what is thought to be a new standpoint, and a form of "precision" moving-iron ammeter and voltmeter with an electrical accuracy of about 0.1 per cent and suitable for use indiscriminately with alternating current and direct current is described. The use of series condensers for the extension of the range of electrostatic voltmeters for extra-high voltage measurements is dealt with, the conditions necessary for the attainment of regional accuracy being considered. The use and limitations of thermo-expansion (hot-wire) ammeters for radio-frequency current measurements are considered, and a current transformer suitable for such measurements up to 1,000 amp. is described. Some recent developments in the field of graphic instruments are dealt with, particularly as regards the "relay" pattern which has proved to be valuable for traction and many other special purposes. A method of insuring constant frequency on a supply system is considered, together with the advantages which accrue, particularly as regards the ease of interlinking and the possibility of driving recorders, time switches, etc., by means of a simple and compact self-starting synchronous motor. The design of current transformers is dealt with in detail, including the use of new materials for the core, permeability and core-loss curves being given.—*Journal of Institution of Electrical Engineers* (*England*), June, 1927.



RELAY GRAPHIC METER OF LATE FORM

Generation, Control, Switching and Protection

Safety Switch Interlock.—A. ROBERT.—Small rural transformer stations where only unskilled supervisory attendance is available should be made foolproof to guard against accidental touching of live high-voltage parts. The article describes an arrangement whereby all high-voltage parts are inclosed in a steel housing. If the inspection door to the housing is opened, a high-voltage air-break switch, mounted on a steel tower above, is automatically opened by means of a rack-and-pinion and lever arrangement. Since the door and the switch are thus mechanically interlocked, the transformer cannot be connected to the line until the door is closed again. If two or more of such transforming posts operate in parallel, the opening of the high-voltage switch alone would not assure the "killing" of the transformer, since excitation would remain from the low-voltage side. In these cases a double mechanical trip can be provided, cutting the transformer off on both sides. This interlocking principle, while designed primarily for small outdoor stations, is applicable also to any indoor cell-system installation.—*Revue Générale de l'Electricité*, June 4, 1927.

Circuit-Breaker Development.—R. M. SPURCK.—Constitutes a résumé of oil-circuit-breaker design problems, of the standardization that has been accomplished in design and manufacture, and of the general trends in design and engineering activities to meet operating requirements. — *Journal of American Institute of Electrical Engineers*, July, 1927.

Motors and Control

Steel-Mill Electric Power Drive.—A. J. WHITCOMB.—This article provides a discussion of the present tendencies in solving problems of electrical distribution and conversion and the use of electric heat in steel-mill work. According to the author, probably the most marked tendency is the rapid electrification of steam-engine-driven mills. Mention is made of the extensive electrification now under way in the plants of the Bethlehem Steel Company. This organization has purchased 20 motors in the last year totaling 60,850 hp. In the case of the blooming mill it is shown that electrical equipment can be fitted to an existing mill without handicapping in any way any piece of mill equipment that may be purchased. At the present time only about 25 per cent of all the motors installed in steel-mill main drives are direct-current machines. The remaining 75 per cent are almost entirely induction motors. Yet during the past year the number of direct-current motors purchased for main-roll service is more than double the number of alternating-current motors. On these drives accuracy and

speed adjustment and regulation, with ease and flexibility of control, are paramount considerations and are characteristic of the direct-current motor installation. — *Industrial Engineer*, June, 1927.

Application of Synchronous Motors in Steel Mills.—H. A. WINNE.—This paper refers to motors furnishing power for machine, roll and other drives in and about steel mills. In the opinion of the author, the high efficiency and power factor of the synchronous motor warrants its careful consideration for constant-speed, general-purpose drives of possibly 50 hp. and greater capacity. The minimum capacity of drive in which the synchronous motor should begin to be considered will, of course, vary in different installations, depending on the size of the power system, existing system power factor and cost of power. Experience, according to the author, has already demonstrated the entire practicability and desirability of using synchronous motors for driving some types of metal rolling mills. The usual large capacity of such units make high efficiency and power factor of extreme importance. It is certain, according to this paper, that synchronous motors will be widely employed in this service in the future.—*Iron and Steel Engineer*, June, 1927.

Electrophysics, Electrochemistry and Batteries

Some Contemporary Advances in Physics—XIII.—KARL K. DARROW.—A careful study of ferromagnetism is undertaken by the author. The first section is devoted to an analysis of the nature of magnetization. The relation between the intensity of magnetization and magnetic fields and the development and exposition of the characteristic curves involving this relationship are next considered. Hysteresis loops, magnetostriction and magnetization as related to temperatures are dealt with. The theories of various kinds accounting for the phenomena are stated and compared. The article closes with a consideration of atomic magnets.—*Reprint, Bell Telephone Laboratories, Inc.*, May, 1927.

Mercury-Arc Rectifier Phenomena.—D. C. PRINCE.—This article is devoted to a consideration of the principles underlying rectifier design. Laboratory data supply the information for consideration of the cathode spot, anodes, total arc drop and the phenomena of the arc-back, with oscillograms, and derived curves are shown.—*Journal of American Institute of Electrical Engineers*, July, 1927.

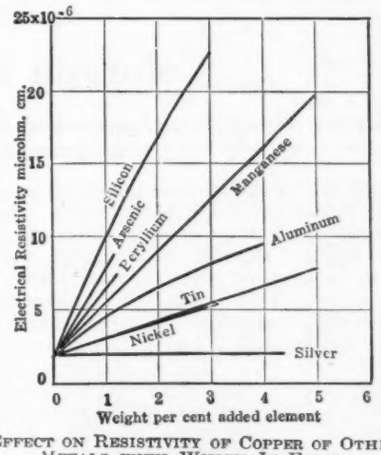
Traction

Gas-Electric Locomotive. — S. DURRENBERGER.—Description of an arrangement of a gasoline-driven yard locomotive with electric transmission between prime mover and driving wheels. The motor is operated at constant output but variable speed. The main generator receives its excitation from an auxiliary axle-driven generator, which in turn derives its own excitation from a storage battery. The handle of this field regulator is combined with the accelerator of the gas motor. A second storage battery, which is in series with the main generator, supplies starting excitation. For this arrangement an over-all efficiency of 75 per cent with a fuel consumption of 0.53 liter of gas per horsepower-hour is claimed.—*Elektrotechnische Zeitschrift*, June 2, 1927.

Swiss Railway Electrification. — H. W. SCHULER.—The plan under which the Swiss Federal Railways are electrifying their lines is described, particular attention being paid to the substation and switching layouts. Single-phase current at 15 kv. will be generated by hydro-electric machines and transmitted to different feeding points, either by 15-kv. underground feeders or 60-kv. overhead transmission lines. The energy transmitted by the 60-kv. lines will be transformed to 15 kv. in 22 substations distributed along railway lines. The majority of these stations will be of the outdoor type.—*Electrical Review* (*England*), June 24, 1927.

Heat Applications and Material Handling

Effect of Impurities in Metals.—C. J. SMITHELLS.—Parts 1 and 2, which appeared in the April and May issues, dealt with the effect of gaseous and non-metallic impurities on the properties of metals and alloys. In the present article the effect of metallic impurities is discussed at some length.—*World Power* (*England*), June, 1927.



EFFECT ON RESISTIVITY OF COPPER OF OTHER METALS WITH WHICH IT FORMS SIMPLE SOLUTIONS

Electrically Heated Industrial Furnaces.—G. KELLER.—The paper describes and advocates muffle ovens and larger industrial furnaces, in which metals can be heated for rolling, drawing, annealing or tempering or for baking lacquer and enamel. The required heat is produced electrically by heating elements, made of spiral wound wire or meander-shaped ribbons. Pyrometer control, either manual or automatic, to maintain a certain temperature, is explained, and induction-voltage regulators are recommended for alternating-current operation. Special constructions for wire-annealing plants and mint works, for steel tempering, enameling ovens and ceramic kilns are described. The economy, cleanliness and high degree of temperature accuracy are emphasized.—*Brown Boveri Mitteilungen*, June, 1927.

Telegraphy, Telephony, Radio and Signals

Short-Wave Wireless Telegraphy.—T. L. ECKERSLEY.—A discussion of short-wave practice and theory, describing experiments made by the author to elucidate short-wave transmission phenomena and certain theoretical developments based on the experiments. In the first section the aërial transmission characteristics are dealt with. In particular, the vertical polar diagrams of transmission are computed, taking account of the earth's resistivity, and it is shown that these are all characterized by the absence of horizontal radiation. It is also shown that the intensity of a low-angle transmission is increased by raising the transmitting aërial. In the second section the results of a series of experiments in which a short-wave radial direction finder is used are described. In the third section the results of a series of long-distance transmission tests are given. Waves between 25 m. and 10 m. were used, and experiments were made which indicated the superiority of a raised doublet over one at the ground level. In the last section the general theory of ionic refraction is discussed in the light of these and other experimental results. The effect of attenuation due to the collision of electrons with molecules is especially stressed, and a novel theory of the skip distance is put forward which has the merit of agreeing closely with the observed results of Heising, Schelleng and Southworth.—*Journal of Institution of Electrical Engineers* (*England*), June, 1927.

Miscellaneous

Layout of Heavy Bus Structures.—W. H. BOYCE.—Outlines of some fundamental facts that should have careful consideration in installing bus-structure equipment in industrial plants. Various methods employed for mounting the bus work, pipe and angle-iron frames, concrete cell structures, and so on, are outlined, as well as the factors reviewed which govern the selection of the copper.—*Industrial Engineer*, June, 1927.

Stresses Occurring in the Walls of an Elliptical Tank Subjected to Low Internal Pressures.—W. M. FRAME.—An exposition of the results of a test made on an elliptical tank and presentation of an analysis, based on experimental data, from which the stresses set up in the walls may be calculated. To account for the fact that the tank appeared stronger than was to be expected from usual assumptions, it was assumed that the wall acted as a beam supported at the top and bottom of the tank. The analysis from this point of view yields results which with reasonable accuracy check with the experimental data.—*Mechanical Engineering*, June, 1927.

Japan and the Electrical Industry.—A. RIDDLE.—An outline of the progress of the electric light and power companies in Japan. The type of equipment, financial set-up and progress in the commercial departments are noted. Data are given for several companies. —*Electrical Review* (*England*), June 24, 1927.

News of the Industry

Alabama Taxes Hydro

Legislature Passes Measure Providing for Two-fifths of a Mill per Kilowatt-hour on all Energy Sold

A TAX of two-fifths of a mill per kilowatt-hour on all hydro-electric power generated and sold is provided in the general revenue bill passed by the Alabama Legislature on July 14. It is reported that Governor Graves will sign the bill as it stands within the ten days allowed, although as ELECTRICAL WORLD goes to press he had not signed.

The section of the bill pertaining to the hydro-electric tax reads as follows: "In addition to all other taxes of every kind now imposed by law or otherwise imposed by this act, there is hereby levied a license or privilege tax upon each person, firm, corporation, agent or officer engaged in the business of manufacturing and selling hydro-electric power in the state of Alabama for the privilege of engaging in such business; said license or privilege tax shall be due and payable in advance on the first day of October of each year, and shall be in a sum equal to two-fifths of a mill upon each kilowatt-hour of hydro-electric power manufactured and sold during the preceding calendar year."

As the Alabama Power Company, the principal company coming under this section of the bill, sold nearly 750,000,000 kw.-hr. of hydro-generated power during 1926, it will have to pay a tax of nearly $300,000 on this energy on Oct. 1. In the years following the tax will increase rapidly as Martin dam will increase this year's output considerably, as will the reconstructed Upper Tallassee plant in 1928 and the new Lock Eighteen plant in 1929. During the next four years the tax will amount to more than $2,000,000, it is estimated.

Other increases of taxes also affect the power company. The franchise tax that was $1 per $1,000 of paid-in capital has been increased to $2, resulting in an increase of $40,000 in this tax. The public utility license tax of 2 mills on gross revenue, which has been increased to 4 mills, will increase this tax by $30,000, and although the city license tax has not been changed, an increase of $20,000 is expected as several of the cities have not in the past taken full advantage of this tax, which is set at 2 per cent of the gross receipts. These taxes total about $390,000. The total taxes paid by the company last year amounted to $921,000.

Protest Potomac Development

The National Popular Government League, an organization advocating government ownership of utilities, whose offices are in Washington, D. C., has filed a protest with the Federal Power Commission against the granting of the application of the Potomac River Corporation for a preliminary permit.

"Since the people in the District of Columbia," says the communication, "have no organized corporate body and can express themselves only through their citizens' foundation and association, we urge upon your commission the necessity of securing a referendum upon this question before action is taken. This great natural property is the greatest asset of the nation's capital and its residents. In the years to come its value to the people of the District of Columbia will become an increasing factor in their daily lives. The Federal Power Commission can, and should, afford to go slowly in granting away this inestimably valuable privilege.

"The preliminary permit is clearly a first step in leasing this power for 50 years to a private corporation. We hold that the city of Washington should be a model in the new art of beauty by electric lighting, as is indicated by the city of Seattle and the plan for the new capital of the Commonwealth of Australia."

In sending out a copy of the letter to the press, the league inclosed a bulletin by Judson King, its director, in which he purports to show the savings which would come to the residents of the District of Columbia were their power furnished by a municipally owned plant like that serving in Tacoma, Wash.

The National Capital Park and Planning Commission, which wants the Potomac River left in its natural state, is influenced by more than scenic considerations, a report submitted to the Federal Power Commission shows. The Park Commission fears for the safety of a part of the city and some of its historical monuments which would be endangered were a break to occur in the proposed chain bridge dam. The storage of 4,560,000,000 cu.ft. of water at the district line would be a menace to the city, particularly in time of war, the report declares.

It is also claimed that the developments of a large amount of power in the Washington area would make it necessary to induce industries to locate there which would be in conflict with the constitutional provision as to the character of the city.

Colorado River Treaty

Upper Tier States Opposed to Any National Legislation Not Based on Seven-State Compact

A CONFERENCE between the seven Colorado River basin states for the purpose of discussing water rights, the Boulder Canyon dam project and other angles of the Colorado River situation will be called by Governor George H. Dern of Utah. The conference probably will be held in August and in Salt Lake City, according to an announcement made by Governor Dern on July 14 while on a visit to San Francisco. The Governors of Wyoming, Colorado and New Mexico will join with Governor Dern in issuing the call for the conference.

The proposed gathering is the result of a series of conferences which the Colorado River Commission of Arizona held recently with Governor Adams of Colorado at Denver, Governor Emerson of Wyoming at Cheyenne and Governor Dern at Salt Lake City and with other officials of those states. A conference also was held by the Colorado River Commission of California with Governor Adams at Denver, and while in Sacramento Governor Dern conferred informally with Governor Young of California.

In his statement relative to the call to be issued Governor Dern said in part:

"Utah and the other upper tier states are in full sympathy with California's needs in connection with the Colorado River development. We are intent that the Swing-Johnson bill be based upon a seven-state ratification instead of the six-state pact at present existing, with California's signature to that having a string attached. Utah's position is that we are opposed to any development on the Colorado River until the Santa Fe pact is ratified by all seven states; therefore we have consistently opposed the Swing-Johnson bill.

"This six-state pact does not give us full protection for we cannot be fully protected so long as one state retains freedom of action. Moreover, if Congress can proceed with development under a six-state pact it also can proceed under a compact ratified by five or four or three, or it can proceed without any state ratification at all, so it will be purely a fiat of the federal government riding roughshod over the inherent reserved rights of the states.

"We of the upper tier states are prepared to stand irrevocably on states rights. Utah contends it owns the bed of the Colorado River and it is an extremely valuable natural asset. The Swing-Johnson bill asserts government ownership of the river bed, which we deny, and Arizona takes the same stand.

"Our attitude toward government aid is that after the government has been repaid for its expenditures it withdraw all claim, just as would a banker withdraw all claim to security after the note has been paid. We also contend that allocation of the water is not the province of the federal government, but the province of the seven states in agreement reached between them.

"Full protection must include a declaration by the states and by Congress that Mexico can never acquire priorities on waters stored in works constructed in and by the United States."

Erection of a large storage and power dam in Black Canyon, is favored by three of the five members of the fact finding advisory commission named by Secretary of the Interior Hubert Work.

Ontario's Rural Lines

Extensive plans are being laid by the Ontario Hydro-Electric Power Commission to meet the growing demand for rural electrification. Hon. J. R. Cooke, Hydro Commissioner, estimates that more than 1,000 miles of rural transmission lines will be approved this year, whereas in 1926 the corresponding figure was 750.

Pursuant to its "grants-in-aid policy" —that is, contributing 50 per cent of the cost of lines and equipment—the Ontario government, in 1926, donated approximately $2,500 per day, while this year its daily subsidizing bill will, in Mr. Cooke's belief, be about $3,500.

An interesting statement regarding Ontario hydro activities is that 30 municipalities are conducting retail stores for the merchandising of electrical appliances. A record of the operation of these stores for the year ended Dec. 31, last, has just been completed. Two stores lost money during the period and 28 show net profits.

Total assets of 30 hydro retail shops for the year amount to $589,282, comprising inventory, $254,046; accounts receivable, $324,256, and office equipment, $10,978. Liabilities balancing the assets comprise the following: Advances from Hydro Department, $578,110; accounts payable, $872, uncollectible accounts, $10,299.

Thirty hydro shops sold merchandise to the value of $1,124,028 during the year, the cost of which merchandise was $822,480, leaving a gross profit of $301,547, or 26.8 per cent. Total expenses for the year were 23.8 per cent, leaving a net profit on the 30 stores of 3 per cent.

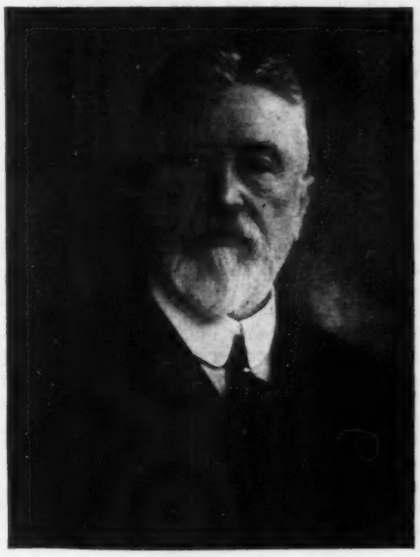
T. N. McCarter Hurt in Automobile Accident

Thomas N. McCarter, president of the Public Service Corporation of New Jersey, was injured in an automobile accident on July 20 while motoring on the Wawa Hill, Baltimore Pike near Media, Pa., en route to visit the new hydro-electric station at Conowingo, Md. A milk truck crashed into Mr. McCarter's car, hurling the chauffeur through the windshield, and Mr. McCarter, after being jolted in the car, fell out just before it overturned, sustaining a broken tendon in the left hand and a cut on the forehead.

This is the second accident to befall Mr. McCarter during the month, his yacht having been destroyed by fire while he was cruising on the Shrewsbury River, in New Jersey, a short while ago. Mr. McCarter and his guests were rescued from the burning craft by a passing boat.

Pioneer Work of Sigmund Bergmann

The death of Dr. Sigmund Bergmann, which was announced in the ELECTRICAL WORLD of July 9, has caused considerable sorrow in the ranks of the Edison Pioneers.



DR. SIGMUND BERGMANN

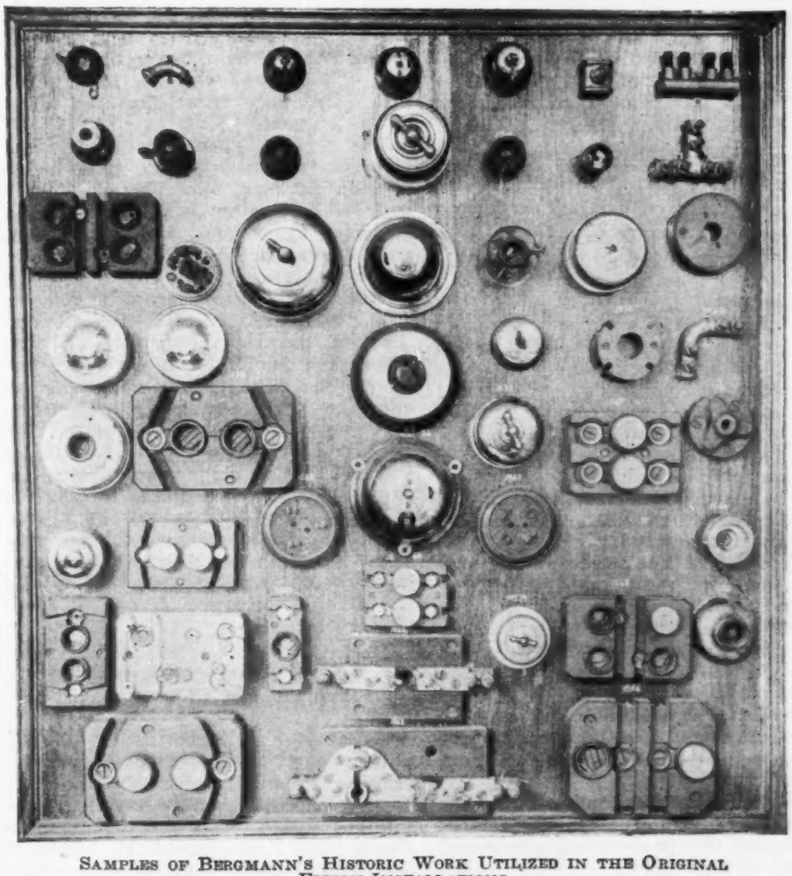
Since publishing the news of his death, we have received the most recent picture of Dr. Bergmann from his son in Berlin. We have also been able to procure a photograph of a panel containing some of the most cherished relics of Dr. Bergmann's early works in connection with the Edison system.

This panel hung in the executive offices of the Bergmann Electrical Works in Berlin for many years. A short while ago Dr. Bergmann sent it to the historical collection maintained by the Edison Pioneers in New York, feeling no doubt that these historic samples would find in the land of their creation a permanent and appreciative resting place.

Virginia Streams Surveyed

Virginia is soon going to know something about its water power. Stream-gaging work is being carried on throughout the state by J. J. Dirzulaitis, hydraulic enginer at the University of Virginia, and two assistants, under the direction of Wilbur A. Nelson, State Geologist of Virginia. Fifty-seven stations on practically all of the major streams in the state are now in operation.

In all, Mr. Nelson says, 31,394 such observations of river stages have been made during the last twelve months. In addition to this, Mr. Dirzulaitis and two assistants have made 263 ratings of stream flow, establishing the velocity of the stream and determining the amount of water flowing by the stations at the time the tests were made. The results of these river stage observations and the rating of the stream flow made during the past several years will be embodied in a bulletin to be published by the state during the coming winter, which will give to the people interested in developing power informa-



SAMPLES OF BERGMANN'S HISTORIC WORK UTILIZED IN THE ORIGINAL EDISON INSTALLATIONS

tion greatly needed and desired at the present time.

Three years ago Virginia had in operation only eight gaging stations and very little was known about water power possibilities. The state had now started to obtain basic data on this important resource, but much is yet to be done and many stations must be installed before all the facts in regard to Virginia's water resources become known.

Tennessee Company Not to Abandon Clinch River Sites

The East Tennessee Development Company will not amend its application for power rights on the Tennessee River so as to exclude the sites on the Clinch River which are under suspension because of the effect the operation of a dam at Cove Creek would have on Muscle Shoals.

In order to develop the maximum resources of the river and to provide the best navigation scheme it is said that the Cove Creek reservoir must supply seasonal storage for the entire series of power plants along the Tennessee River. This would mean that the power plant at the dam would be closed certain months of the year, and this method of operation could not be followed by a lessee independent of the operators of the sites on the main river.

On the other hand, if operated so as to produce the maximum amount of power at the Cove Creek plant the storage would be of little value to the Tennessee River projects, as a large part of the water would be turned into the Tennessee at a time when the other tributaries would be supplying ample water.

An effort will be made to attach a provision to the Mississippi flood control legislation which would authorize the federal government to build the Cove Creek dam.

Iowa Utility Suspends Service

The Iowa Public Service Company, successor to the Iowa Light, Heat & Power Company, brought a three-year litigation between the utilities concern and Sac City, Iowa, to a climax the night of July 13, when it suspended service, after Judge E. G. Albert of the Iowa Supreme Court handed down a ruling that the company's franchise had terminated and that it could no longer furnish electric power for the city.

For several months a majority of business places and residences have been supplied from the Sac County Electric Company, which was granted its franchise nearly three years ago, after notice had been served on the Iowa Light, Heat & Power Company that the city had terminated its franchise. The contract contained this provision with a guarantee that in event of such action the city would pay for its distribution system. The company asked for removal of the system, but this was denied. Settlement upon payment for the system will be undertaken at the next term of court.

The city had voted bonds, during the war, for establishment of a municipal system, but this project was abandoned because of high prices.

Superpower in Scotland

First Development of Electricity Board Will Be Placed in Operation in Central Scotland in 1929

THE Central Electricity Board, established under the electricity (supply) act of 1926, for the purpose of reorganizing and standardizing the generation and supply of electric current in the United Kingdom, has completed details of the first extensive development of its proposed program.

The plans to be effected are concerned more with organization and distribution of output than reduction of power costs or improvements in operating efficiency. In the area concerned, covering some 4,980 square miles, which includes almost the entire industrial, coal and shipbuilding activities of Scotland, there are now 42 companies owning 36 generating stations which are supplying electricity.

Under the proposed scheme these 36 generating stations will ultimately be reduced to ten selected stations, of which four will be superpower steam-driven stations already in existence, two water-power plants on the Clyde and two new superpower stations to be erected later, the whole program to require a ten-year period for completion. Under full developments the output will be concentrated in six superpower stations, the stations at Bonnybridge, Dundee, Dunfermline and Kilmarnock probably being closed down after 1941.

Another feature of the scheme is the standardization of frequency involving the conversion of the Clyde Valley and Glasgow Corporation systems from their present frequency of 25 cycles to the national standard of 50 cycles. At present this is now being done in the city of Glasgow, where a change has also been made from direct to alternating current.

The scheme, known as the Central struction of an overhead main transmission network, operating at 132,000 volts, to link up the selected generating stations. These lines, with substations, will be constructed by the board in five stages covering the period 1928-33 at a total capital expenditure of $9,000,000.

The scheme known as the Central Scotland Electricity Scheme, 1927, was before the public for a period of one month for the purpose of giving an opportunity for criticism or objections. The commissioners contemplate that the board will be able to begin supplying electricity under the scheme in August, 1929, and estimate that in the four years 1930-34 there will be a gross saving to the companies in the area of no less than $4,000,000. These savings should increase steadily as the use of electricity grows.

Shows Weakness of the Home Rule Theory

Expansion and growth of electric utilities to their present degree of development and service would never have been possible under so-called home rule regulation of these companies, declared the Hon. David H. Jackson, chairman Illinois Commerce Commission, before a meeting of the Electric Association of Chicago on Thursday of last week. The utilities no longer operate within a single municipality and no small sized city is equipped to and cannot administer local jurisdiction to the benefit of the general public, he said.

Under the existing commission form of regulation it has been possible to work out general rate schedules, set up uniform accounting systems and facilitate the interconnection of different companies, thereby improving and broadening their service. "Would this have been possible with home rule?" asked Judge Jackson. Utility securities have now become prime paper for investment, he further pointed out, and questioned whether this position could be maintained if a thousand and one different city administrations were empowered with regulatory authority.

Judge Jackson cited specific instances where commission jurisdiction had benefited both the public and the utilities and closed his remarks by urging utility men, when they go to the commission with any request, to lay all their cards on the table at once in order to save the time of the commission, the utility and the public.

Northwest Association Completes Executive Committee

With the designation of section chairmen at a meeting at Portland, Ore., July 7, the administrative personnel of the Northwest Electric Light and Power Association is now complete. The appointments were as follows: Accounting, F. W. Brownell, comptroller Puget Sound Power & Light Company, Seattle; commercial, J. C. Plankington, sales manager Northwestern Electric Company, Portland; engineering, O. L. LeFever, superintendent Northwestern Electric Company, and public relations, George L. Myers, assistant to the president Pacific Power & Light Company, Portland.

The executive committee also accepted the offer of *Electrical West* to use its Northwest office at 1206 Spalding Building, Portland, as headquarters and the services of Berkeley Snow, its Northwest editor, as secretary. In addition, W. E. Hudleson, Portland Electric Power Company, was appointed assistant to the president, and A. J. Johnstone, auditor Portland Electric Power Company, was appointed treasurer.

The completed executive committee is as follows: President, A. C. McMicken, general sales manager Portland Electric Power Company, Portland; vice-president at large, R. M. Boykin, manager central district, Puget Sound Power & Light Company, Seattle; vice-president for Idaho, R. B. King, superintendent Idaho Power Company, Boise; vice-president for Montana, W. B. McDonald, manager Mountain States Power Company, Kalispell; vice-president for Oregon, Z. E. Merrill, assistant general manager Mountain States Power Company, Albany; vice-president for Utah, P. M. Parry, commercial manager Utah Power & Light Company, Salt Lake City; vice-president for Washington,

Lewis A. Lewis, sales manager Washington Water Power Company, Spokane; retiring president, D. C. Green, vice-president and general manager Utah Power & Light Company, Salt Lake City; members at large, representing the utilities, J. P. Lottridge, vice-president and general manager Eastern Oregon Light & Power Company, Baker; representing the manufacturers, A. S. Moody, Northwest manager General Electric Company, Portland; representing the jobbers, J. I. Colwell, Northwest manager Graybar Electric Company, Seattle, and the four section chairmen.

New Rural Rate in Effect in Alabama

The Alabama Power Company has filed a rural rate schedule which was made effective by the Alabama Public Service Commission on July 16. The rural rate takes the form of a graduated service charge, depending on customer density and a low energy charge. Some new and interesting features are embodied in the rate structure, such as classifying rural customers into four density groups and making provision for seasonal power use.

The new rate is known as "Service Classification E" and is available to any consumer served from a rural distribution line of the company for electric lighting, cooking, heating, refrigeration or farm power service, or any combination of these, where the total consumption can be measured by one meter. A rural line is defined as "Any electrical distribution line of 11,000 volts or less, not within the corporate limits of a municipality which serves less than twenty customers per mile of pole line.

The commission has reserved the right to apply this rate to lines in small municipalities on application by the power company and at the request of the customers, thus enabling such small communities to obtain service from rural lines when service could not be made available at existing rates.

The new rate is so constructed that when the number of customers on any rural line reaches twenty per mile of pole line, the rates which have been designed and adopted for city service become applicable.

Rural lines of the Alabama Power Company have grown from 39 miles serving 240 customers in 1924 to 398 miles serving 3,368 customers on Jan. 1, 1927.

Fresh Plans for Saguenay

British Capitalists See Quebec's Great Water-Power Source and May Invest Many Millions

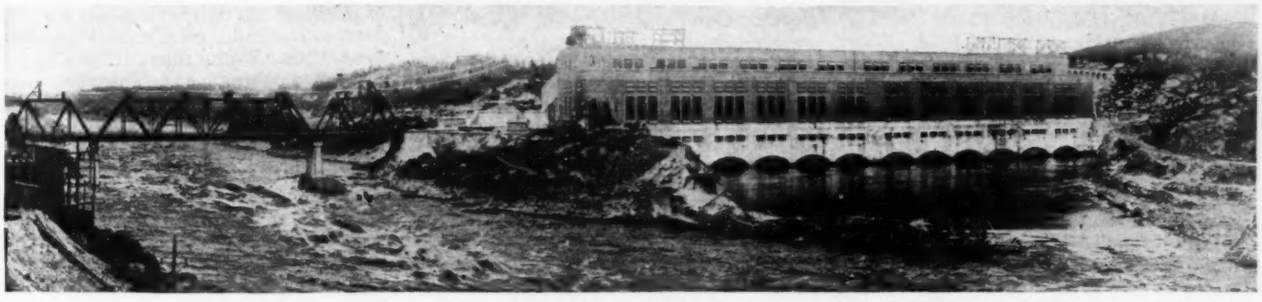
INTENDED invasion of the Lake St. John and Saguenay River districts of the Province of Quebec by British capitalists has served to awaken fresh interest in the power development projects under way in those districts and the possibilities for future developments. A number of British financiers, including Lord Gainford, Sir George Courthope and W. T. A. Proctor, visited the Lake St. John district recently and were said to be greatly impressed with what they saw. It is their intention to return in the fall with a larger party, when a more exhaustive investigation will be made.

It is understood that a syndicate, said to be one of the strongest ever formed in England, has been organized to undertake developments in the next five years running into the hundred millions. The first undertaking will be the construction of a railway around Lake St. John to extend northward to Lake Chibougamou. Negotiations are said to be already under way for important power sites on the Saguenay and other rivers which will be needed in connection with pulp and paper projects which the syndicate has in view.

The power developments of the Duke-Price Power Company and the Aluminum Company of Canada in this district have often been referred to in these columns. They are rapidly growing toward their ultimate proportions. Duke-Price added two units of 45,000 hp. each to its Ile Maligne development in 1926. The present installation totals 450,000 hp., and the ultimate capacity is to be 540,000 hp. The power house is on the downstream end of Ile Maligne, the last island on the Grand Décharge, which with a smaller channel carries the waters of the lake 10 miles to where the river proper begins. The mean low-water level of the river at this point is 105 ft. below the ordinary water level of Lake St. John.

The remainder of the fall in the Sanguenay River to tidewater at Chicoutimi is being developed by the Aluminum Company of Canada. Work is under way at Chute à Caron which will ultimately add 800,000 hp. to the power supply of this district. Part of this power is to be transmitted to Quebec to supply the rapidly growing demand there, but the greater part will be consumed by the various industries which are moving to this section. The company is already operating its reduction works at the new town of Arvida with power from Ile Maligne.

At River Bend, on the Little Décharge River, Price Brothers have their big newsprint mill. This mill is operated as regards both motive power and steam generation by hydro-electric power supplied from the Duke-Price development. Water powers controlled by Price Brothers have a total estimated capacity in excess of 125,000 hp., at present developed to a rated capacity of 63,200 hp. The principal developed powers are at Chute aux Galets on the Shipshaw River, with rated capacity of 17,600 hp.; at Kenogami, with rated capacity of 19,900 hp., and at Chicoutimi, with rated capacity of 8,000 hp. The company also controls extensive undeveloped sites on the Shipshaw River; at Sault au Cochan, on the St. Lawrence, below the mouth of the Saguenay, and at Rimouski. The largest of these is the Wilson power site on the Shipshaw River, which is capable of developing 25,000 hp.



ILE MALIGNE PLANT OF DUKE-PRICE POWER COMPANY ABOVE THE SAGUENAY RIVER, QUEBEC

Progress of the Central Maine Power Company

Steady progress in the utilization of Maine hydro-electric power was emphasized in the latest quarterly letter to stockholders of the Central Maine Power Company by President W. S. Wyman. During the past three months increased sales have been made from the output of the new Gulf Island hydro-electric station, and during June the company generated an average of almost 100,000 kw.-hr. a day more than in June, 1926. Present indications point to the sale of the complete Gulf Island output of 300,000 kw.-hr. per day during 1928, not more than two years from the date of its completion. This plant was built at once to its ultimate rating. President Wyman further pointed out that the cities of Lewiston and Auburn will receive about $60,000 a year in taxes from this station. It is operated by seven men.

Another important hydraulic project is under way at Brassua Lake on the headwaters of the Kennebec River in the shape of a storage dam which will impound about ten billion cubic feet of water for use during dry periods. This is being built by various power owners at a total cost of about $1,100,000, the Central Maine's share being 40 per

cent. The work was begun about three years ago and is now nearing completion.

Within the past few weeks the New England Public Service Company has purchased the property of the Bath Iron Works at Bath, Me., as well as certain other industrial property in New England, and it intends to assist actively in getting new enterprises established in favorable locations where old ones have gone out. This, President Wyman says, would not be possible for the Central Maine company to attempt alone on any substantial scale, but the work is practicable on account of the utility being a part of an enterprising holding-company organization.

The Central Maine is now occupying its new office building at Augusta in connection with the New England Public Service organization. The engineering department has been transferred from Waterville and the load dispatchers have been established at Augusta after twenty years' service at the Fort Halifax station. The building is of fireproof construction and contains more than 27,000 sq.ft. of floor space.

Electric Baking Equipment Discussed

East Central Division at Cedar Point Meeting Hears Advantages of Electric Ovens Acclaimed and Elects Officers

THE following officers were elected at the meeting of the East Central Geographic Division of the National Electric Light Association, held at Cedar Point, Ohio, July 12 to 15: C. I. Weaver, president, Springfield, Ohio; C. S. McCalla, first vice-president, Youngstown, Ohio; G. E. Miller, second vice-president, Cleveland, Ohio; L. B. Hearrington, third vice-president, Louisville, Ky.; D. L. Gaskill, secretary-treasurer, Greenville, Ohio. Executive committee, T. B. Wilson, Louisville, Ky.; O. H. Hutchings, Dayton, Ohio; T. O. Kennedy, Cleveland, Ohio; A. Bliss McCrum, Charleston, W. Va.; C. P. Billings, Pittsburgh, Pa., and J. P. Pope, Lexington, Ky. (ex officio).

ELECTRIC BAKING

The session of July 14 was devoted to a presentation of papers on and discussion of electric baking. A. N. Otis of the General Electric Company outlined the general characteristics of load and operation of electric ovens, concluding with a summary of the advantages of this type of heating.

C. B. Eggert, chief engineer Baker-Perkins Company, Inc., sketched the development of ovens and cited several modern installations of electric baking equipment, emphasizing their particular points of favor.

R. M. Crawford, Oven Equipment & Manufacturing Company, dwelt on the need for co-operation among oven manufacturers, utilities and the baking companies.

A. F. Lutz, chief baker of Fisher Brothers Company, Cleveland, and in direct charge of its electric baking work, expressed himself enthusiastically over bake oven performance.

Grant Call of the Edison Electric Appliance Company, Chicago, urged the need of clarifying many of the details of selling current-consuming equipment to the public and stated that the utility does not sufficiently encourage the merchandising efforts of the equipment houses.

NATIONAL AFFAIRS

During the afternoon of July 14 addresses were made by H. T. Sands, president, and Paul S. Clapp, managing director of the national association. Both speakers touched on the national issues involved in interconnections crossing state boundaries and the dangers lurking in government ownership and control of utility systems.

T. O. Kennedy of the Ohio Public Service Company spoke of the public's ownership of utility companies' stocks and what it presaged for the industry in expansion and public responsibility.

The final session on July 15 was devoted to accounting, addresses being made by Dean Madden of New York University, W. B. S. Winans of New York and J. J. McKenna of Louisville.

Maryland Commission Again Forbids Merger

Reaffirming its former stand, the Maryland Public Service Commission last week again denied the Electric Public Utilities Company of Chicago the right to purchase four small power companies in western Maryland at a price of $518,000. The four companies sought by the Chicago company are the Home Electric Company of Lonaconing, the Emmitsburg Electric Company, the Antietam Electric Light & Power Company and the Midland Electric Light Company. The order issued stated that no evidence in the rehearing of the case showed that the first order was "unjust or unwarranted, or that the order should be abrogated, changed or modified in any respect."

At the first hearing on the application of the Chicago company to purchase the four companies it was testified by H. Carl Wolf, chief engineer of the commission, that the reproduction cost of all the companies, less depreciation, would not exceed $242,000. Officials of the petitioning company, however, asserted that it was their belief that the properties they proposed to purchase were worth the amount specified in the petition. They told the commission that the proposed purchase price of $518,000 would not be considered as a rate base. Residents and townships in western Maryland opposed the sale of the plants. In refusing its consent the commission reiterated the condemnation which it had visited a few days before in another case on what it called the "scramble" of holding companies to buy isolated plants at inflated values. The latter decision is quoted from this week under "Commission Rulings" (page 185).

Coast Meeting of A.I.E.E.

Exceptionally Fine Program Planned for Institute Convention at Del Monte on Sept. 13-16

A WEEK of profitable and pleasurable activity is in store for the delegates and guests who will attend the annual Pacific Coast convention of the American Institute of Electrical Engineers at Del Monte, Cal., Sept. 13-16. This is one of the three annual national conventions of the Institute. Under the direction of P. M. Downing, San Francisco, regional vice-president of the A.I.E.E., the definite aim of all of the committees is to present a program of exceptionally high character. The number of papers to be presented has been kept down to provide time for discussion.

The first day (Tuesday) will be given over to registration and sessions of delegates from the various student branches, to which all delegates are invited. The student conference will be in charge of R. W. Sorensen, professor of electrical engineering at the California Institute of Technology, Pasadena. On Wednesday, Thursday and Friday mornings and Thursday afternoon there will be technical sessions. On Wednesday evening President Gherardi will preside over a general meeting to be addressed by Dr. Harris J. Ryan on "Phases of Future Electrical Development." The banquet will be held Thursday evening. Wednesday and Friday afternoons and Saturday will be open for recreation and trips. The latter include visits to the Pit River and Melones projects of the Pacific Gas & Electric Company, the Feather River project of the Great Western Power Company, the Kings River project of the San Joaquin Light & Power Corporation and the Big Creek development of the Southern California Edison Company, to say nothing of the plants in the San Francisco Bay region. At the Ryan high-tension laboratory at Stanford University Dr. Ryan himself will be the host.

Following is the list of technical papers:

WEDNESDAY, SEPT. 14

Morning.—"Relation Between Frequency and Sparkover Voltage in a Sphere-Gap Voltmeter," Lester E. Reukema; "The Space Charge That Surrounds a Conductor in Corona," J. S. Carroll and Mr. Lusignan; "Electric Oscillations in the Double-Circuit, Three-Phase Transmission Line," Mr. Satch.

THURSDAY, SEPT. 15

Morning.—"Advance Planning and Practices in Long-Distance Communication," Mr. Chamberlin; "Tandem System of Handling Toll Calls In and About Los Angeles," Messrs. Jacobsen and Wheelock; "Coupling Capacitors for Carrier-Current Communication Over Power Lines," Mr. Belt; "Carrier-Current Relay Protection," Mr. Fitzgerald.

Afternoon.—"Transients Due to Short Circuits (study of tests made on Southern California Edison 220-kv. system)," R. J. C. Wood and Messrs. Hunt and Griscom; "Equipment for 220-Kv. Systems," J. P. Jollyman; "Application of Intermediate Synchronous Condenser Stations to Long-Distance Transmission Lines," Messrs. Evans and Wagner; "Synchronous Condensers," Mr. Alger.

FRIDAY, SEPT. 16

Morning. — "Oscillographic Recording Apparatus for Transmission-Line Studies," J. W. Legg; "High-Voltage Oil Circuit Breakers for Transmission Networks, Messrs. Wilkins and Crellin; "Lightning Protection for Oil-Storage Tanks and Reservoirs," R. W. Sorensen and Messrs. Hamilton and Haywood; "Lightning Protection for Oil Tanks," Mr. Schaeffer.

Dr. Hadley Gives His Views on Reasonable Rates

Dr. Arthur Twining Hadley, noted economist and former president of Yale University, in a recent address at Philadelphia declared that public utility rates can be productive of the best results, in terms of public usefulness, only if they are based upon consideration both of those using the service and of those furnishing it. "Everybody agrees that rates should be reasonable," Dr. Hadley said; "but what is a reasonable rate? And how shall we go to work to obtain it?"

Seven main principles underlie the establishment of equitable public utility rates, according to Dr. Hadley. They are as follows:

"Rate regulation must be considered from producers' and consumers' points of view.

"If scarcity has made the price high, let capital have sufficient freedom to remove that scarcity.

"Permanent reduction of price is even surer to follow when we have large units of capital invested, for the large unit must make sales to cover its overhead and can profitably reduce rates to this end.

"Progressive industries depend for their success upon rendering increased service at lower unit cost.

"Reducing rates to cost, permitting only normal profit, without allowance for risk, prevents the introduction of modern improvements and thereby defeats its own ends.

"Historical cost as a basis for rate-making is wrong in principle and dangerous in practice. If a rate is low in comparison with what prevails under similar conditions elsewhere and has developed traffic to an unusual degree, the profit has been well earned.

"Perhaps most important and oftenest ignored is the principle that public service commissions should have opportunity to study the history of past attempts at regulation and economic principles which have determined their success or failure. They should not be so overwhelmed with specific cases and complaints as to have no time for dealing with general questions of economic policy."

Germany to Hold Conference on Engineering Materials

The German Engineering Association (Verein deutscher Ingenieure), in conjunction with other leading engineering societies, is arranging a conference on engineering materials, which will be held in Berlin next fall, from Oct. 22 to Nov. 13. Papers dealing with all branches of technology and a comprehensive exhibition of materials, with a special section for demonstrations of testing, will, the promoters think, bring closer collaboration between producers and consumers on the one hand and men of science and practical engineers on the other, besides proving of great importance in the further development of power economics. Three hundred papers will be read, and prominent German and foreign engineers and scientists will lecture.

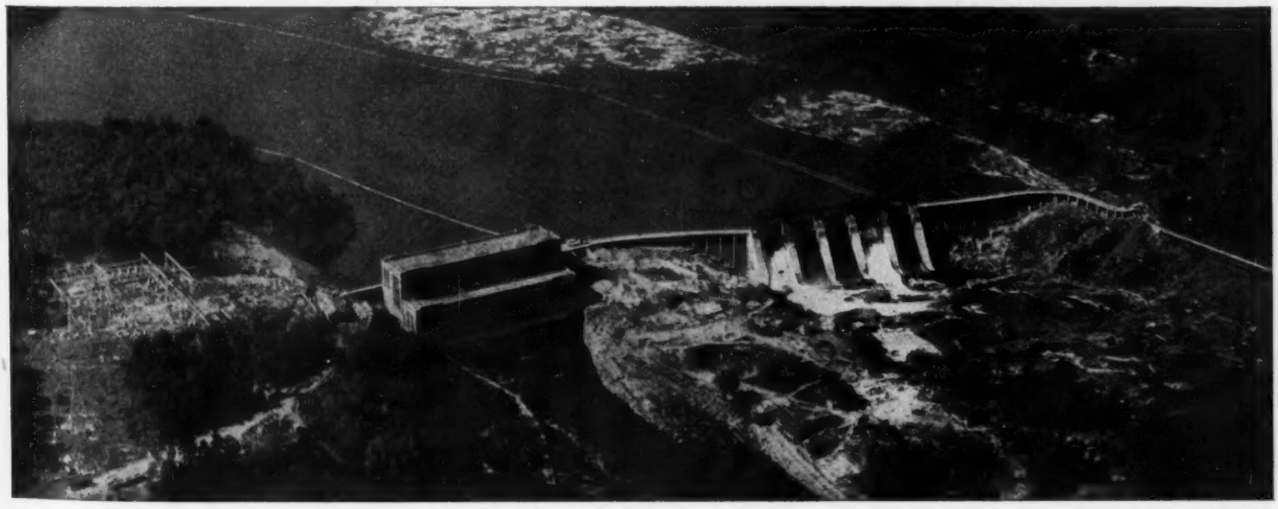
Briefer News

Public Service Corporation to Launch Stock Campaign.—In the autumn the Public Service Corporation of New Jersey will carry out a new popular ownership campaign for the sale of 6 per cent cumulative preferred stock. This new drive for customer stockholders marks the thirteenth campaign in a series which the New Jersey company started in 1921.

Lighting an International Bridge.—The Buffalo General Electric Company is installing 400-cp. incandescent lights on the new four-million-dollar Peace Bridge from Buffalo to Fort Erie, Ontario. The lights are arranged in single standards along the mile-long span and create a blaze of light discernible for a great distance along Lake Erie and the Niagara River.

Electrification of Georgia Horseshoe-Making Plant.—Horseshoes are not yet obsolete, and one of the four largest plants for their manufacture in the United States and the only one of its kind in the Southeast, owned by the Dixie Horseshoe Manufacturing Company, is about to be established with complete electric drive in Georgia, where it will turn out between four and five carloads of horseshoes a day. Power will be furnished by the new plant of the Georgia Power Company at Tallapoosa. The machinery being installed has a capacity of about 700

Gatineau Power Company's Chelsea Plant Starts with Rating of 102,000 Hp.



ABOVE is the most recent photograph of the new power development of the Gatineau Power Company at Chelsea, Quebec. This plant is one of three under construction on the Gatineau River. It is not yet complete, but three power units of 34,000 hp. each are in operation, supplying power to the mills of the International Paper Company at East Templeton, 5 miles away. The plant is on the west side of the river, where five gates control the flow of water. There is an effective head of 95 ft. of water, with a minimum of 88 ft. and a maximum of 100 ft., and this, with the power machinery installed, will permit the development of 170,000 hp. Much of the power now being developed is being used for the development of steam at the East Templeton mills, but eventually much of it will be exported to Ontario, to be used by the Ontario Hydro-Electric Power Commission.

The building in which the power machinery is housed is constructed in three steps. The heavy generators and turbines are on the lowest floor; the transformers, one for each generator, are on the next step, and above them are the control room and transmission layouts. A bridge leads out over the river so that the gates controlling the flow of water may be inspected. On the farther side of the river there is a log chute, 7,100 ft. long, which carries the logs from the water above the Chelsea plant to a point below the Farmers Rapids plant, more than a mile away. The chute has been made necessary by the fact that the water between the two mills is comparatively still, and if the logs were let through, tugs would have to be used to float them down the river.

hp., and it is estimated that the plant will utilize approximately 720,000 kw.-hr. a year.

Kansas Electric Power Building Line from Lawrence to Topeka.—Construction is well under way on the 66-kv. single-circuit, 25-mile transmission line which the Kansas Electric Power Company is building to connect Lawrence with the Tecumseh plant of the Kansas Power & Light Company, 6 miles east of Topeka. The line will be of single-pole, two-arm construction. At Lawrence a 500-kva. substation will be built.

Harvesting by Electric Light.—John Treinen, a big wheat farmer of Cheyenne County, in the Nebraska Panhandle, will do a part of his harvesting by electric light. Treinen has 900 acres in wheat that will average about 30 bushels to the acre. The crop has ripened so rapidly that in order to avoid loss he will operate his combination harvesting and threshing machine night and day. Treinen started raising wheat twelve years ago on raw land with but small capital. He has completely electrified his farm and home.

New England Hydro Power to Build Boston Water Supply.—Extensive additions to the water supply of the Boston metropolitan district recently started in central Massachusetts are to have the benefit of New England Power Company service during the construction period as the result of a contract lately placed by the Metropolitan District Water Supply Commission. A 15-mile, 66-kv. line is soon to be completed from West Boylston to Coldbrook to supply energy for building operations, in the construction of a tunnel to conduct the waters of the Ware and Swift Rivers into the Boston supply system. The capacity of the line will be about 6,500 hp. and local distribution will be at 22 kv.

Construction in South Mississippi.—Several million dollars has been spent during the first six months of 1927 by the Mississippi Power & Light Company in Jackson and south Mississippi, according to an announcement by C. P. Couch, vice-president and general manager of the company. From Jackson south to the Louisiana State Line at Osyka a 110,000-volt line has been constructed and will soon be put in service. This line will bring electrical energy to Terry, Hazlehurst, Brookhaven, Summit, McComb, Magnolia and Osyka. Many industries have been electrified, and the waterworks at Hazlehurst and Magnolia are now operated by electricity.

Tidal Power Utilization in France.—The Société d'Entreprises Hydrauliques et d'Utilisation Industrielle des Marées, a Paris company, is erecting a plant near St. Malo, Brittany, to utilize the power of the tides for the generation of electric power. The plant will be located in the estuary of the River Rance, about 6 miles from St. Malo, and will, it is predicted, have a capacity of 450,000,000 kw.-hr. a year. In this district there is said to be a maximum difference of more than 55 ft. between high and low tides. The undertaking is being financed by the French government and by the authorities of the Department of Ille-et-Vilaine.

United States-Mexican Commission on International Rivers Proposed in Mexico.—An international water commission to dispose of problems connected with the Colorado Rio Grande and Tia Juana Rivers will be suggested to the United States by the Mexican government, according to an official statement made by Dr. José G. Parras, Sub-Secretary of Agriculture and Public Development, in Mexico City. To make possible the setting up of this commission the Mexican government will seek a treaty with the United States. Mexican plans for arranging the distribution of the waters of the three rivers are complete and await the approval of President Calles before being submitted to the United States, according to the statement.

League of Nations Issues Memorandum on the Electrical Industry.—A comprehensive memorandum on the electrotechnical industry has been issued as part of the documentation of the International Economic Conference, which held its sessions at Geneva in May. The document was prepared by the Economic and Financial Section of the League of Nations from information furnished to it by governments, by members of the preparatory committee for the conference and by industrial organizations. The salient phases of the subject and its international aspects are examined, and the statistical tables and summaries are comprehensive, authentic and up to date. The memorandum is obtainable for $1 from the World Peace Foundation, 40 Mount Vernon Street, Boston.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see the ELECTRICAL WORLD for July 2, page 50.]

Association of Electragists International—Hotel Chase, St. Louis, Aug. 8-12. L. W. Davis, 15 W. 37th St., New York.

International Association of Municipal Electricians—Salt Lake City, Aug. 16-19. E. H. Benz, West New York, N. J.

Camp Co-operation VII—Association Island, Henderson Harbor, N. Y., Aug. 28-31. Society for Electrical Development, 420 Lexington Ave., New York.

National Electrical Manufacturers' Association—Policies Division, Association Island, N. Y., Sept. 1-3; Apparatus Division, Briarcliff, N. Y., Oct. 24-27.

New England Division, N.E.L.A.—New London, Conn., Sept. 12-15. Miss O. A. Bursiel, 20 Providence St., Boston.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Sept. 13-16. F. L. Hutchinson, 36 West 39th St., New York.

American Electric Railway Association—Cleveland, Oct. 3-7. J. W. Welsh, 292 Madison Ave., New York.

Empire State Gas and Electric Association — Lake Placid Club, Lake Placid, N. Y., Oct. 6 and 7. C. H. B. Chapin, Grand Central Terminal, New York.

Illuminating Engineering Society — Edgewater Beach Hotel, Chicago, Oct. 11-14. L. H. Graves, 29 West 39th St., New York City.

Eastern Association of Electrical Inspectors — Springfield, Mass., Oct. 12-13. E. P. Slack, 85 John St., New York.

Rocky Mountain Division, N.E.L.A.—Broadmoor Hotel, Colorado Springs, Col., Oct. 17-20. O. A. Weller, 900 15th St., Denver.

National Association of Railroad and Utilities Commissioners — Dallas, Tex., Oct. 18-21. James B. Walker, 270 Madison Ave., New York.

Britain's Largest Generators Ordered.—Two great steam-electric generating units, the generators of which will, it is said, be larger than any hitherto installed in the United Kingdom, are the subject of an important contract which the London Power Company has just placed with the Metropolitan-Vickers Electrical Company of Manchester. The units are rated at about 37,500 kw. each. The value of the contract is about $1,250,000, and to carry it out will provide employment for a year for a thousand men. The new equipment is for extensions to the Deptford West power station, on the south bank of the River Thames. Nearly 5 tons of air a minute will be circulated to keep the two generators cool, and at full load more than 60 tons of coal an hour will be consumed.

An Up-to-Date Ranch in Texas.—Electric power companies of Texas are pointing to the 50,000-acre ranch of C. L. Martin, situated 5 miles south of Mason, as an example of what may be accomplished for home life and outdoor duties by the installation of electrical energy. It is asserted that the Martin estate is electrified with a completeness that exceeds anything of the kind in Texas. Virtually every mechanical contrivance in the home, the barn, stables, branding pen, farm and ranch is operated by electricity. An electric branding iron is used to brand the valves, electric machinery milks the cows; electric brushes rub the horses; electric pumps hoist the water from the wells; electric churns make the butter; electric washing machines clean the clothes. Cooking and most household duties are performed by electric power, and the large stone home is heated by electric stoves. The residence and all outbuildings are electrically lighted.

Musical Tower of Jewels Will Be Feature of Cleveland Exposition.—A musical tower of jewels, rising from a varicolored cascade of falling water and terminating 220 ft. above with a "sunburst" of gems illuminated by the rays from 36 8,000,000-hp. searchlamps, will be the outstanding spectacular feature of Cleveland's industrial exposition, which opens Aug. 6. Within this ornamental cascade, entirely concealed behind panels of fine netting, will be six "Super-Panatropes," a new auditorium loud speaker recently perfected in the research laboratories of the General Electric Company. This will be the first demonstration of this new device, which in tests at Schenectady had been heard for more than a half mile with such volume as to be enjoyed. This

unique electrical spectacle is the contrivance of J. W. Gosling, decorative designer of the General Electric Illuminating laboratories. It will be erected in the center of the esplanade.

Alabama Power Company Contemplates New Hydro-Electric Plant.—A new dam and hydro-electric power station is under consideration by the Alabama Power Company at a point one mile above Croft's Ferry, 12 miles east of Gadsden. Test holes have been sunk, and should conditions prove satisfactory to the company, the dam will be built and will be a factor in the comprehensive plan to open the Coosa River to navigation from Rome, Ga., to the Gulf, electric power being generated as part of the enterprise.

Secretary Work to Fix Policy for Government Power Plant at Guernsey, Wyo.—Secretary Work of the Interior Department has left Washington on a six weeks' tour of reclamation projects and Indian reservations. One of the purposes of the trip is to decide upon a policy in connection with the distribution of power from the Government irrigation plant at the Guernsey (Wyo.) dam. The market for power is increasing rapidly in the vicinity of the plant, which has a capacity of 3,500 hp. Power is sold at the switchboard, and present returns are in excess of $100,000 annually. An addition is under construction and will be ready for service before the end of the year which will make an additional 3,500 hp. available. As already reported, a transmission line is being built along the Platte River which will make the power available to other municipalities. The profits from sale of power are expected to be sufficient to pay the greater part of the cost of the dam, thereby relieving the water users of that charge.

Suit for Revocation of Federal Power License.—A novel question—whether the United States is a necessary party to a suit to compel the Federal Power Commission to revoke a license to a power company on the ground that the land covered by the license belongs to the petitioner and not to the United States—has been presented to the federal Supreme Court in the case of Peale vs. Federal Power Commission. The case involves a preliminary permit and a license issued by the Federal Power Commission to the San Joaquin Light & Power Corporation, covering a half section in Fresno County, Cal. Mr. Peale contends that the land, the record title to which is in the United States, in fact belongs to him and that the permit and license constitute a cloud upon its title. In the brief filed for the respondents it is contended that the United States is an indispensable party. The brief states that the legal title to the land is in the United States by virtue of a deed from the predecessors in interest of the petitioner. It is said that the force and effect of this deed is challenged. In this connection the brief says that the Federal Power Commission has no authority under the act creating it to revoke any license or permit as the petitioner seeks to have it ordered to do so.

Commission Rulings

Illinois Commission Approves Maximum-Demand Rate on Room Basis.—In approving the new rate schedule of the Central Illinois Public Service Company, referred to under "Briefer News" on July 9, the Illinois Commerce Commission said: "For some years the commission has conducted intensive studies of forms of rate schedules for supplying lighting service to residences and commercial customers. It has been convinced from this study that the different types of schedules have a very important effect upon the ability of the customer to use electric service freely and at reasonable cost. The commission has recently been conferring with the Central Illinois Public Service Company on this matter, and as a result the company has agreed to try out in this territory a new type of lighting rates for residential service, known as the maximum-demand rate on a room basis."

Excessive Prices for Isolated Plants Condemned.—In approving the application of the Eastern Shore Gas & Electric Company for authority to purchase the municipal power plant at Snow Hill, Md., the Maryland Public Service Commission declared the price paid ($35,250) far too much. "Only the manifest advantage to the people of Snow Hill moves the commission to approve the sale at such an excessive price," it said. The commission recalled that two years ago the Eastern Shore company offered $16,000 for the same property. This sale was held invalid, however, until it was authorized by the Legislature and approved by the commission. "The property has acquired no additional value in two years," the opinion st ted. "Why, then, is the company willing to pay almost twice as much at this time and another company [the Electric & Ice Manufacturing Company of Pocomoke, controlled by the East Coast Utilities Company] willing to pay more than twice as much? This commission," the opinion asserted, "views with grave concern the scramble of holding companies for small, isolated and often entirely obsolete electric and other utility properties and their willingness to pay for such properties prices far beyond the cost of reproducing them. It is convinced that the prices paid in excess of the actual value of such properties comes in one form or another and in the long run out of the public's pocket. The money represented by these excessive prices is not a gift to the owners of these properties; it is paid only because the purchasers expect to make a profit out of it, either in the rates charged for service or in the scale of securities based on the stocks of the acquired properties. Such transactions do not appear to the commission to be in the public interest. This commission in two ways can and does protect the public from rates based on such prices: First, by requiring any excess in the price beyond what the commission determines as a fair value of the property to be amortized out of surplus or stockholders' profits, and, second, by establishing rates that will yield no more than a fair return on the value thus established. The commission expects to continue this policy and will scrutinize with the utmost care each proposition of the sort submitted to it. Actual and tangible benefits to the public must be shown in order to secure commission approval."

Recent Court Decisions

Law Prohibiting Tapping of Electric Wires Constitutional. — The Vermont Supreme Court has held, in State vs. Shady, that a statute prohibiting the tapping of wires and using the electric current therefrom without the consent of the corporation owning the same is not unconstitutional as discriminating against individual owners of electric lines. There is nothing in the record to show that a single electric line was owned by a natural person at the time of the enactment of the law, and the court assumed that all such lines were owned by corporations. (136 At. 26.)*

Power Company's Prescriptive Right to Overflow Land by Dam Held for Jury.—Holding that a verdict of $28,000 against a dam owner (Castor vs. Northern Indiana Power Company) for overflowing and injuring 600 acres of plaintiff's land was not excessive, the Appellate Court of Indiana said that the prescriptive right of flowing back water by means of a dam is measured by the extent to which the right is enjoyed, extending only as far as the land has been habitually overflowed, and that when a power company claimed the right to overflow and did overflow the plaintiff's land, under an alleged prescriptive right, the extent of such overflow and the duration of the exercise of the right were questions of fact for the jury. (156 N. E. 571.)

Rule of "Res Ipsa Loquitur" in Injury Suits. — The Supreme Court of Ohio has sustained the Ohio Court of Appeals in reversing an award of damages (Glowacki vs. North Western Ohio Railway & Power Company) in a case where a five-year-old child picked up the end of a broken trolley wire lying in the street and was severely burned. The company's defense was that the wire had been severed by a bullet fired by an unknown person, that it was properly installed and that the company knew nothing of its severance until after the accident. The higher courts found that the trial judge had erred in his exposition to the jury of the legal rule of *res ipsa loquitur* ("the thing speaks for itself"). This rule, the Supreme Court held, is not a substantive rule of law, but an inferential rule of evidence which the jury itself —not the court—must draw where an accusation of negligence is made. (157 N. E. 21.)

Men of the Industry

J. F. McGuire New President of North Central Division

J. F. McGuire, manager of the Fargo division Northern States Power Company, was elected president of the North Central Electric Association at the annual convention held June 24-27 in the form of a cruise on Lake Superior.

Mr. McGuire was born in Chicago on April 16, 1881, and received his education in that city, attending De Paul University and Lewis Institute. He started his business career with the Commonwealth Edison Company of Chicago, entering the meter department, and was later transferred to the contract department. When H. M. Byllesby & Company organized a new business department in 1909, he entered their employ and worked successfully at Ottumwa, Faribault, Mankato and Sioux Falls, and in 1913 was appointed manager of the Northern States Power Company office at Minot, N. D. In September, 1923, he was transferred to Fargo, N. D., to the position which he now holds.

J. F. McGuire

Mr. McGuire served as vice-president of the North Dakota Safety Council during the year 1926-1927, which was its organization year. He is a director of the North Dakota State Fair Association, a member of the Rotary Club, and chairman of the industrial committee of the Fargo Commercial Club.

Richard Howarth, assistant treasurer, has been appointed treasurer of the Twin State Gas & Electric Company, Boston, succeeding H. L. Harris.

W. G. Holmes, formerly manager of the industrial development department of the Interstate Public Service Company, Indianapolis, has been appointed to a similar position with the National Electric Power Company and its subsidiaries.

W. L. Barrett, who for the last five years has been manager of the Texas-Louisiana Power Company at Ranger, Tex., has been appointed district manager of the western division of the company with headquarters in Breckenridge, Tex. Carroll A. Reeves, who has been connected with the Ranger office of the company, will assume the duties of manager.

Samuel C. Moore, general manager of the New England Power Association, Worcester, Mass., has been elected a director of the Massachusetts Utilities Investment Trust, Boston.

Percy S. Young, vice-president in charge of finance of the Public Service Electric & Gas Company, Newark, N. J., is at the present time touring Europe. Mr. Young will return from abroad late in August.

J. O. Henkel, Jr., formerly district manager at Montgomery for the Alabama Power Company, has been appointed manager of the company's northern division, with headquarters at Huntsville.

Howard T. East, service engineer with the Public Service Company of Northern Illinois, has been appointed assistant to the vice-president in charge of public relations and service. Mr. East will continue to perform the duties of service engineer in addition to such special work as may be assigned him by Vice-president Bradley.

L. R. Nichols, formerly electrical superintendent of the Glens Falls district of the Adirondack Power & Light Corporation, has been appointed electrical superintendent of the northern division of the company. Mr. Nichols has been identified with the Adirondack organization at Spier Falls, Utica and Oneida.

T. B. Wilson, vice-president and general manager of the Louisville (Ky.) Gas & Electric Company, has been made acting chairman of the Plan and Schedule Committee organized for the purpose of raising funds to advertise the city of Louisville. According to present plans $200,000 a year will be raised and expended over a period of three years. The new organization will probably act jointly with the recently formed Kentucky Chamber of Commerce in the effort to advertise Louisville and the state of Kentucky.

R. E. Ritchie, who has been serving as assistant general superintendent of the Arkansas Power & Light Company, has been made assistant to the president. Mr. Ritchie, formerly associated with the St. Louis Southwestern Railway Company, began service with the Arkansas Power & Light Company four years ago as chief clerk to the vice-president and general manager, and two years ago he was made assistant general superintendent.

Elmer A. Holbrook, dean of the School of Mines and Metallurgy of Pennsylvania State College, has been appointed dean of the Schools of Engineering and Mines at the University of Pittsburgh to succeed Dr. Frederick L. Bishop, who has retired from that office. Following graduation from the Massachusetts Institute of Technology Mr. Holbrook engaged in practical mining work in the United States, Mexico and Canada and more recently he has been identified with the United States Bureau of Mines. His academic work has included connections with the Nova Scotia Technical College, the University of Illinois and Pennsylvania State College.

J. D. Bowles Assumes Greater Responsibilities

John D. Bowles, who was recently appointed a vice-president of the Federal Light & Traction Company, as already announced in the ELECTRICAL WORLD, has been chief engineer of that organization since 1920. Prior to that time Mr. Bowles was engaged in rate investigations and general engineering work for the company after serving for three years as superintendent of one of its Western properties. From 1913 to 1915 Mr. Bowles was connected with the Missouri Public Service Commission as chief of its department of electricity, gas, water and heating.

J. D. Bowles

Mr. Bowles is a graduate of the electrical engineering department of the University of Missouri, class of 1909, and for a year was a research assistant in its engineering experiment station, receiving a post-graduate degree in 1910. For three years thereafter he was connected with the F. E. Newberry Electric Company of St. Louis and Chicago in general engineering and contracting work. He is a member of the American Institute of Electrical Engineers, American Society of Mechanical Engineers and other technical societies and has been active in committee work with the A.I.E.E. and N.E.L.A.

H. B. Simons, who has been connected with the engineering section of the electrical department of the Montreal Light, Heat & Power Consolidated since 1920, has resigned. Mr. Simons has been identified with the company since 1904 and has been a member of the electrical department since 1920.

George F. Heustis, who has been connected with the Adirondack Power & Light Corporation since 1924, has been appointed resident manager of the Glens Falls district of that company. Mr. Heustis' former connections included affiliation with the Fall River Electric Light Company in the capacity of superintendent, with the Fitchburg Gas & Electric Company in the capacity

of superintendent of construction and with the Malden electric plant of Charles H. Tenney & Company in the capacity of superintendent.

W. R. Begg of the firm of Hornblower, Miller & Garrison, lawyers, has been elected a member of the board of directors of the American Brown Boveri Electric Corporation. Mr. Begg also serves on the directorate of other industrial organizations.

Louis O. Langworthy, formerly superintendent of the Bradford (Pa.) Electric Company, has been promoted to the position of commercial manager of the company. **W. H. Brown** has been made manager of the operating department of the same company.

George W. Quentin, formerly promotion manager of the ELECTRICAL WORLD, has been appointed sales engineer of the American Transformer Company, Newark, N. J. Mr. Quentin brings to his new position a broad knowledge of sales work obtained through many years of experience in the public utility and industrial fields. Before becoming affiliated with the ELECTRICAL WORLD he was identified with the Pittsburgh office of the American Blower Company and prior to that connection he served as power sales engineer with the Duquesne Light Company. Earlier in his career he was connected with the J. G. Brill Company, the American Gas & Electric Company and the Westinghouse Electric & Manufacturing Company. As sales engineer of the American Transformer Company Mr. Quentin will spend the larger portion of his time in the field, studying the problems of the company's customers and working out with them the best methods of adopting and using transformers for all special purposes. He is a member of the A.I.E.E., of the Engineers' Society of Western Pennsylvania and of the Yale Engineering Association.

E. E. Hill, superintendent of the meter department of the New York Edison Company, has been appointed chairman of the national meter committee of the National Electric Light Association. Mr. Hill comes to the chairmanship of this important technical committee with a sound background of central station experience, supplemented by several years of committee experience in the National Electric Light Association and other technical associations. Specifically, on the National Electric Light Association national meter committee he has successively served as member for approximately ten years and recently as the chairman of the editing sub-committee, secretary and vice-chairman. As the superintendent of the meter department of the New York Edison Company Mr. Hill is responsible for the maintenance of all the watt-hour meters and in the Manhattan territory, for the installation of the meters and service equipment. Mr. Hill has for the past few years served on many technical committees in connection with the Meter Code, the Meterman's Handbook, wiring matters, standardization questions, etc. He has just finished his term of office as chairman of the engineering division of the Metropolitan New York Section, N.E.L.A.

P. O. Reyneau Joins Cutter Company

Paul O. Reyneau has just affiliated himself with the Cutter Electrical & Manufacturing Company of Philadelphia, Pa. Due to his long experience both in engineering and operating with electric light and power companies and his consequent knowledge of their problems he will devote the major portion of his time to developing applications for air circuit breakers in the utility field. For the past 3½ years he has been consulting engineer for the American Gas Company, Philadelphia, remaining with that organization until its recent merger with the United Gas Improvement Company.

Mr. Reyneau's first electrical work was as an employee of the Telluride Power Company. Later in his career he became identified with the overhead

P. O. REYNEAU

lines department of the Detroit Edison Company, subsequently serving as distribution engineer and still later as assistant electrical engineer, holding the last named position until his resignation to become affiliated with the Philadelphia Electric Company in charge of transmission and distribution design. It was in 1923 that he joined the American Gas Company. Mr. Reyneau has been active in association work.

P. L. Paxton, a native of Buena Vista (Va.) and a graduate of Virginia Military Institute at Lexington, Va., has been appointed general superintendent of the northern department of the Virginia Public Service Company, with headquarters at Alexandria.

W. C. Burbage, manager at Carthage for the Tennessee Electric Power Company, has been transferred to Murfreesboro and his place taken at Carthage by W. P. Ledford, recently with the Tampa (Fla.) municipal power plant.

D. C. Hawley has been made acting head of the underground construction department of the Kansas City Power & Light Company to succeed T. C. Ruhling, whose resignation has already been announced in the ELECTRICAL WORLD. Mr. Hawley has been connected with the company for eight years, engaging in the construction of underground conduit systems. Previous to his association with the Kansas City Power & Light Company in 1919, Mr. Hawley spent many years of service in underground work.

D. C. Stukey, formerly connected with the Chicago Heights office of the Public Service Company of Northern Illinois, has been transferred to Evanston in the capacity of district engineer.

Edward Whitlock, who has been connected with the business department of the Virginia Electric & Power Company at Richmond, has been transferred to the Suffolk office as sales manager to succeed Malcolm Anthony, who has assumed new duties with the Western Public Service Company, which is a Stone & Webster property.

Obituary

Charles B. Hutchinson, district manager for the Southern California Edison Company at Fullerton, Cal., died July 9, at the age of 53, after a long illness. He entered the employ of the Edison company in 1916 as salesman, successively holding district office positions until the time of his death.

Eduardo Ortiz, prominent Mexican engineer and assistant secretary of the Department of Communications, died on July 14 in Mexico City. He had formerly been with the Hudson Tunnels in New York, where he was well known in engineering circles. Much of the credit for the improved telegraphic communication between the United States and Mexico is due to Mr. Ortiz. He was a member of the American Institute of Electrical Engineers.

Harley W. Brundige, president of the California Railroad Commission, died suddenly Saturday, July 16. Death followed an attack of acute indigestion. Mr. Brundige was born in Kingston, Ohio, and started a newspaper career in Missouri. He was city editor and later managing editor of the Kansas City *Star* before removing to Los Angeles in 1902. For eighteen years he was associated with the Los Angeles *Express*. Seven years ago he was appointed to the Railroad Commission by Governor Stephens and later reappointed by Governor Richardson.

Dr. Arthur A. Hamerschlag, president of the Research Corporation of the Carnegie Institute of Technology, died July 20 in Roosevelt Hospital, New York, following an intestinal operation. A native of Nebraska and a graduate of Lehigh University, Dr. Hamerschlag became one of the country's distinguished educators. He served as president of the Carnegie Institute of Technology from 1903 to 1922 and also directed industrial research in the office of Major-General George W. Goethals. Dr. Hamerschlag engaged in independent practice as a consulting electrical and mechanical engineer for many corporations.

Raymond I. Carruthers, acting district manager at Fullerton, Cal., for the Southern California Edison Company, died July 10, at the age of 42, after a long illness resulting from an automobile accident. He was employed first as a solicitor by the Southern California Edison Company in 1910, later holding important district office positions until 1925, when he was made assistant sales manager of the company.

Financial and Statistical

Manufacturing Stocks Firm Common Issues Up Slightly Bond Market Inactive

INTEREST in the utility group centered for a time this week in certain of the electrical manufacturing stocks, notably General Electric Company and Westinghouse Electric & Manufacturing Company. The former reached a high of 124¾, which raises the previous high point for the year and compares with a low of 81 for 1927. The Westinghouse issues advanced generally, first preferred showing a gain in one day of four points to 90. Some of the smaller equipment stocks, on the other hand, showed further weakness.

Among the common stocks of power and light companies some substantial advances took place during the week, but averages remain little changed. Brooklyn Edison was among the leaders, showing an advance of seven points to 176, and Detroit Edison passed the 150 mark. The average of fifteen representative power and light stocks rose one point to 106 during the week ended July 20, against 92 a year ago and 95 at the beginning of 1927.

On the New York Curb and over-the-counter markets stocks have remained little changed. The bond market generally is inactive.

Financial Details of Indiana Merger Announced

Particulars as to the way in which the consolidation of several Indiana utility companies into the Indiana Electric Corporation will be effected, subject to the approval of the Public Service Commission of Indiana, have been announced. As the first steps in the consolidation as now planned, the Central Indiana Power Company will directly acquire the assets of five of its subsidiaries, canceling all secured obligations except those in the hands of the public (totaling $2,015,350), and assuming the latter as divisional underlying liens of the resultant merged company. The Terre Haute, Indianapolis & Eastern Traction Company will reduce the number of its subsidiaries through the formation of a new subsidiary (Indiana Central Rapid Transit Company), which will take over three traction subsidiaries and certain traction properties of the parent company.

Upon completion of the preliminary adjustments, the Indiana Electric Corporation will acquire by purchase or consolidation all the property, franchises and other assets of the Central Indiana Power Company and all the property, franchises and other assets of the Terre Haute, Indianapolis & Eastern Traction Company, including the entire common stock of the Indiana Central Rapid Transit Company to be presently outstanding, and will also acquire all the property, franchises and other assets of the Terre Haute Traction & Light Company, all in consideration for certain acts and for the issuance of certain bonds and stocks or payment of cash, or both, in accordance with the full details of the plan. If the plan is carried out in full, the new company, Indiana Electric Corporation, will have outstanding with the public $30,967,000 in capital stock, consisting of $8,792,000 7 per cent cumulative prior preferred, $7,165,000 7 per cent cumulative preferred, $10,010,000 participating adjustment preferred, and $15,000,000 common, the latter to be adjusted subject to approval of the Public Service Commission of Indiana.

Standard Gas & Electric Customer-Ownership Sales

Customer-ownership sales of preferred shares at the subsidiary properties of Standard Gas & Electric Company for the month of June totaled $1,643,300 par value, there having been 2,611 separate transactions.

U. G. I. Directors Vote Stock Increase

Directors of the United Gas Improvement Company on July 13 voted to increase the capital stock $4,678,000 by adding 93,560 shares, bringing the total to 2,130,088 shares.

This increase is to be used partly in exchange and payment for 58,980 shares of the no-par stock of Day & Zimmermann, Inc., and 2,017 shares in exchange and payment for a like number of shares of no-par preferred stock of the same company, and 38,461 shares in payment of stock of the Hartford City Gas Light Company, and 204,481 shares of the no-par stock and 8,361 of the no-par preferred stock of Connecticut Gas & Coke Securities Company.

A special meeting of the stockholders will be held on Sept. 15 to act on the increase and amendments to the by-laws of the company, increasing the number of directors to twelve, including the president, who shall be ex officio a member of the board, and increasing the quorum to seven.

Capitalization of Premiums Defended*

Massachusetts Senate Bill 170 Proposes to Authorize the Issue of Additional Shares at Par to Equal the Premiums Already Paid by Stockholders

By Carl D. Jackson
General Counsel National Electric Light Association

STATUTES in general throughout the country provide that stock must be issued for an equivalent par either in cash, property or labor. Most statutes prohibit the issuance of paid-up stock for a less consideration than the par value. Many commissions are given authority to permit the issuance of stock at less than par or to determine the amount to be allowed for the cost of sale thereof. The statutes of other states do not require the sale at a premium. In general, utilities are authorized to issue securities to reimburse the treasury for expenditures for improvements and extensions, and this permits the sale of securities against invested surplus. This is permitted even in those states, of which there are a few, having provisions prohibiting the issue of stock dividends in the case of utilities. While Massachusetts provides that new issues shall not make the total securities in excess of the value of its property, it does not provide that securities may be issued equal or nearly equal the value thereof.

The statutes of Massachusetts necessarily operate in most instances to assure a capitalization far below the value of the property. The evident purpose and object of the statute have been given effect over a long series of years by the administrative authorities of the state, so that in general it may be said that the par value of securities of utilities outstanding in Massachusetts is not only below the value or cost of the utility property, but in fact, in many instances, bears no relation whatever to either the value or cost of the property. While "prudent investment" is sometimes referred to as the primary factor in regulation in Massachusetts, it is questionable, at least to an outsider, what is meant by this term. In the decided cases, the amount of securities outstanding is often referred to and statements can be found that might indicate that investment represents merely the amount paid into the utility for securities issued. On the other hand, most cases seem to recognize that reinvested surplus must be taken into account as part of the rate base. I do not know of any commission decisions that have denied the right to earn on invested surplus. The statutes of the state mention neither premiums nor investment as factors in fixing rates for public utility service.

Burden of the Premium Law

Formerly the commission was required to fix the price "not less than

*From brief filed at a public hearing ordered by the Legislature of Massachusetts before the Department of Public Utilities.

market value" of the stock, and in so doing was required to take "into account previous sales of stock of the corporation and other pertinent conditions." Subsequently, although the price was primarily fixed by the directors, the commission was required to find that the price was not so low as to be inconsistent with the public interest, which the commission probably properly interpreted, in view of the history of the statutes, to be a price closely approaching market value. It is impossible to fix a premium on the stock to be issued without giving some effect to dividends, payments, or possibilities. Isolated sales in the market, especially where the securities are not being constantly dealt in, cannot be, and in fact have not been, taken by the administrative bodies of Massachusetts as representing the premium that shall be required on utility security issues.

The public and the commission have assumed that in order to carry out the spirit of this law, a price must be fixed that will give comparatively little, if any, value to the stockholders' rights, and it might be assumed then if stockholders' rights turn out to be of much, if any, value, that the commission has not been competent to perform its duty. If, on the other hand, in order to avoid substantial value in rights, it has fixed a price at which the stock will not sell to the stockholders or at auction, it will be criticised. It has already been pointed out many times that the burden in this respect amounts to requiring the commission to perform a really impossible task.

The corporate laws having required the public to take stock sometimes at heavy premiums, the commission has found itself under at least a moral obligation to endeavor to maintain the price at not less than that at which it has required stock to be sold. As the price at which stock at any period will sell depends upon money conditions and existing earnings, the prices are likely to be very high in periods of low interest and plentiful money and prosperity and perhaps recede very greatly in any period of adversity or high interest rates. The net result is a necessary tendency to continue dividends and perhaps increase them to uphold the price of the stock, yet new stock must necessarily be sold very often at prices lower than the commission fixed for previous issues. If this were always a fault of utility management, the stockholder might perhaps reasonably assume the burden and the obligation. Where, however, it must often necessarily arise from economic conditions over which neither the commission nor the utility has control, the state through its commission has assumed an obligation which it never has been required to assume.

Liberal dividends increase the value of stock. The premium on issues necessitates maintenance of dividends, and in time of depression increased dividends if the premium price is to be retained, and so the circle will continue.

SUBNORMAL SECURITY ISSUES

It is a well-known fact that utilities in Massachusetts are financed largely and in many instances wholly by stock issues, and in Massachusetts utility stocks have been placed nearer on the basis of secured bond issues than upon the basis normally occupied by corporate common stock. To some extent they have perhaps combined with the security of a bond issue some of the advantages of profit which go normally with common stock preceded by bond issues and preferred stock. Earnings have been plowed under to build up an equity back of the stock corresponding to what is usually known as an equity back of secured bonds. If administrative rulings of the state deny capital-

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday July 19	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	99¼	83	99¼
Adirondack Pwr. & Lt.—7% pf.	110	107	111½
Adirondack Pwr. & Lt.—8% pf.	114	112	115
Ala. Pwr., $7 cum. pf.—no par	110	107	112½
Allis-Chalmers Mfg., 7% pf.	m111½	109	112½
Allis-Chalmers Mfg., 6% com.	109¼	88	111½
Aluminum Co. of Amer., com.	84	....	....
Aluminum Co. of Amer., 6% pf.	101	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	100	86½	102
Amer. & Foreign Pwr., com.—no par.	21½	18½	25½
Amer. Bosch Magneto, com.—no par	22½	13	22½
Amer. Brown Boveri Elect.	12	10½	39½
Amer. Brown Boveri Elec., pf. $7.	k 62½	50½	98
Amer. Gas & Elec., 6% pf.—no par.	99½	95½	101½
Amer. Gas & Elec., com.†—no par.	89½	68½	100½
Amer. Lt. & Trac., 6% pf.	115	112	120
Amer. Lt. & Trac., new com.	171	167	178½
Amer. Pwr. & Lt., 6% pf.	101½	97½	106½
Amer. Pwr. & Lt., com.†—no par.	62½	54	67
Amer. Pub. Serv., 7% pf.	a 98½	94	104
Amer. Pub. Serv., com.†	65	....	....
Amer. Pub. Utilities, 7% pfc. pf.	86	74	90
Amer. Pub. Utilities, 7% pr. pf.	a 93	93	96
Amer. Pub. Utilities, com.	k 57	65	70
Amer. States Sec., A	3	2½	4½
Amer. States Sec., B	3	2½	4½
Amer. Superpwr., 6% pfc. pf.—25.	29½	26½	29½
Amer. Superpwr., 6% 1st pf.	l 96	....	....
Amer. Superpwr., Class A†—no par.	k 36½	27½	38½
Amer. Superpwr., Class B†—no par.	36½	28½	39½
Amer. Wtr. Wks. & Elec., 7% pf.	111½	105	111½
Amer. W. W. & E., com. $1.60—20.	91	62½	98
Anaconda Copper cap. $3.	45	41½	49½
Appalachian Electric Pwr., 7% pf.	101½	100	105
Appalachian Elec. Pwr., 7% 2nd pf.	102	100	102
Appalachian Elec. Pwr., com.	m78	....	....
Arizona Pwr., 7% pf.	k 79	77	84½
Arizona Pwr., com.	m 22	....	....
Arkansas Pwr. & Lt. 7% pf.	102½	....	....
Assoc. Gas & Elec., $3.50—50.	51	....	....
Assoc. Gas & Elec., pf.—$6—no par.	92	85	93
Assoc. G. & E., Class A, 10—no par.	40	35	43
BABCOCK & WILCOX, 7% com.	114	113	124
Binghamton L., H. & P., $6 pf.	96	93	98
Birmingham Elec., pf.—$7—no par.	108	105	109
Blackstone Valley G. & E., 6% pf.	106	103	105
Blackstone Valley Gas & Elec., 10% com.—50	k133	98	153
Blaw-Knox, com.†	l 73	70	73
Brazilian Trac., Lt. & pwr., com.†	f168½	....	....
Broad River Pwr., 7% pf.	100½	97	100
Brooklyn Edison, 8% com.	175½	148½	176
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	l 25½	....	....
Buffalo, Niagara & East. Pwr. com. $1—no par	l 32½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	97½	96	99½
California Ry. & Pwr., 7% pf.	135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	l108½	107	108½
Central & S.W. Util., $7 pf.—no par	a 97½	93½	93½
Central & S.W. Util., pr.in.$7 pf.—no par	k 99	97	101
Central Ariz. Lt. & Pwr., 8% pf.	k 97	95	98
Central Ark. Ry. & Lt., 7% pf.	102	100	104
Central Ill. Pub. Serv., $6 pf.	a 91½	88½	95½
Central Ind. Pwr., 7% pf.	92	86	95
Central Pwr. & Lt., 7% pf.	102	100½	103
Central States Elec., 7% pf.	95	93	96
Central States Elec., com.†	m200	....	....
Century Elec., 6% com.	m115	115	115
Chicago Fuse Mfg., com.—$2.50 no par	a 35	30	35
Cincinnati Gas & Elec., 5% com.	g 99	96½	99
Cities Service, 6% pf.	l 87½	87½	90½
Cities Service, pf. B—10	l 8	7½	8½
Cities Service, pf. BB—100	l 82	81	85
Cities Service, com.—20	l 45½	40½	58½
Cities Service, Bks. Shrs.—10	l 22½	23	29½
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Ilg., 6% pf.	110½	108	110
Cleveland Elec. Ilk., 10% com.	295	285	310
Columbia Gas & Elec., 6% pf.	k105½	99½	107½
Columbia G. & E. com. $5—no par.	94½	82½	98½
Columbia Ry., Gas & Elec., 6% pf.	106	....	....
Columbus Elec. & Pwr., $2 com.—no par	70	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	102½	98½	102½
Columbus Ry., Pwr. & Lt., 6½% pf. B	100½	96	103½
Columbus Ry., P. & L., com.—no par	93	75	79
Commonwealth Edison, 8% com.	a151½	138	155
Commonwealth Pwr., 6% pf.	98½	91½	100
Commonw'th Pwr., $2, com.—no par	53½	48½	54½
Conn. Lt. & Pwr., 8% pf.	k120	119	123
Conn. Lt. & Pwr., 7% pf.	117	112	113½
Cons. Gas of N. Y., pf.	97½	93	97½
Cons. Gas of N. Y., com $5—no par.	107½	94	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	k105	105	107
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e112½	110½	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e115	112½	115½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e129½	127	129½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par	e 58½	51	59½
Consolidated Pwr. & Lt., 7% pf.	105	100	106
Consumers Pwr., 6% pf.	101½	100	102
Consumers Pwr., 6.6% pf.	105	103	105½
Continental Gas & Elec., 8% pfc. pf.	106	103	106½
Continental Gas & Elec., 7% pr. pf.	101½	100	103
Conti. G. & E. com. $4.40—no par.	k210	210	225
Crocker Wheeler, com.†	27	30	38
Crocker Wheeler, 7% pf.	84	78	88
DALLAS PWR. & LT., 7% pf.	108	107	109½
Dayton Pwr. & Lt., 6% pf.	106	101	103
Detroit Edison, 8% com.	149½	133½	157
Dubilier Condenser, com.—no par.	k 4½	3½	5½
Duquesne Lt., 7% pf.	116½	114½	116½
EASTERN NEW YORK UTIL., $7 pf.	105	102	104½
Eastern New York Util. com.	65	70	75
Eastern States Pwr., $7, com.	9	9	13
Eastern States Pwr., pf.	92	90	95
East. Tex. Elec., 7% pf.	107	106	108
Edison Elec. of Boston, $12 com.	d242	217	267
El Paso Elec., 7% pf.	106	105	107½
Elec. Bond & Share, 6% pf.	l107½	105½	109
Elec. Bd. & Sh. Sec., com. $1—no par	l 75½	67½	79½
Electric Household Util.†	a 12½	11	15½
Elec. Investors, 6% pf.—no par.	94	92	96
Elec. Investors, com.†—no par.	37½	32½	40½
Elec. Investors, 10% pd. receipts.	m 15	....	....
Elec. Pwr. & Lt., ctfs. pf.	104	96	106½
Elec. Pwr. & Lt., ctfs., 40% pd.	k112½	103½	115
Elec. Pwr. & Lt., ctfs, full pd.	m114	108½	111½
Elec. Pwr. & Lt., ctfs., com.—no par.	22½	16½	23½
Elec. Refrig. cap.†	17½	12½	37½
Elec. Ry. Securities, com.—no par.	7½	....	....
Elec. St. Battery com. $5.25—no par	68½	63½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	102	99	101½
Emerson Elec., pf.	b109	107½	111
Empire Pwr., pfc.†	35	....	....
Engr. Pub. Serv., $7 pf.—no par.	103	93½	106½
Engr. Pub. Serv., com.—no par.	27½	21½	28½
Eureka Vacuum Cleaner, com. $4—no par.	73½	60½	74½
FAIRBANKS MORSE, 7% pf.	k108	107½	112
F.-M., com.—$3—no par.	38½	37½	43½
Federal Lt. & Trac., com. $1.40	42½	37½	47
Federal Lt. & Trac., $6 pf.—no par.	k 98	91½	99½
Ft. Worth Pwr. & Lt., 7% pf.	l110½	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	73	68	72
Galveston-Houston Elec., com.	24	28	32
Gen. Elec., $3 com.—no par.	124½	81	124½
Gen. Elec., special—6%	11½	11	11½
Gen. Gas & Elec. (Del.) com. A. $1.50—no par	40½	34	47½
Gen. G. & E. (Del.) com. B—no par.	m 43½	35½	43½
Gen. G. & E. (Del.) pf. A. $8—no par.	k115½	113½	126
Gen. G. & E. (Del.) pf. A $7—no par.	k107½	100	109½
Gen G. & E. (Del.) pf. B $7.	k102	96	105
Gen. Pub. Serv., $7 cum pf., no par.	k107	102	106
Gen. Pub. Serv., com., no par.	13½	11½	15½
Ga. Lt., Pwr. & Rys., 6% pf.	94	87	92
Ga. Lt., Pwr., & Rys., com.	m 45	....	....
Ga. Ry. & Pwr., 8% pf.	k123	119	123
Ga. Ry. & Pwr., 7% pf.	113	106	110
Gt. Western Pwr., 7% pf.	h102	....	....
IDAHO PWR., 7% pf.	106½	103	105
Ill. No. Utilities, 6% pf.	a 96½	92	97
Ill. Pwr. & Lt., 7% pf.	97	99	101
Ingersoll Rand com. $8.	k 87½	88½	96½
Int. Combus. Engr., com. $2—no par	46½	43½	64
Int. Util., Class A—$3.50—no par ex. div.	k 38½	24	41½
Int. Utilities, Class B—no par.	k 5½	3	7½
Interstate Pwr., pf.—$7—no par.	94	93	98
Interstate Pub. Serv., 7% pf.	99	98	99½
Iowa Ry. & Lt., 7% pf.	97½	97	99
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	100	97½	103
Johns-Manville, com.†—no par.	82½	55½	86

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *l*Pittsburgh; *j*Washington. *k*Bid price Saturday, July 16. *l*Bid price Wednesday, July 20. *m*Latest quotations available. †Dividend rate variable.

ization to plowed-in earnings representing surplus the utilities can distribute the surplus and require capitalization of new property.

The result of the system is, first, in many instances, a par capitalization entirely out of line with the cost or value of the property, and, secondly, dividends on the par of stock which to those who are unfamiliar with the value or cost of property might seem excessive. Such dividends must necessarily follow from a par capitalization way below cost or value, and would also follow in those cases where the stockholders decline to plow under their earnings for fear that the state would eventually refuse to recognize their ownership in the property representing earnings devoted to improvements and extensions. Some expressions in the decisions of Massachusetts commissions have been interpreted as casting a cloud upon the right of the corporation to earn upon plant and facility extension and improvement paid for out of earnings. From either point of view, dividends on par value have necessarily assumed a proportion which might lead to misunderstanding, although it is clear that such dividends may in no way be out of proportion to a reasonable return upon the value or the cost of the plant devoted to public use.

LEGAL PRINCIPLES TO BE CONSIDERED

The matter must be considered in connection with legal principles applicable to Massachusetts as well as elsewhere in the country. "A public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public equal to that generally being made at the same time and in the same general part of the country on investments in other business undertakings which are attended by corresponding risks and uncertainties." (Bluefield Waterworks & Improvement Co., 262 U. S. 679,692.) The power to regulate is a legislative power and is subject only to such restrictions as are imposed upon legislative action by the Federal Constitution and by the constitution of the state in question. In the 14th amendment to the Federal Constitution it is provided, among other things: "Nor shall any state deprive any person of life, liberty or property without due process of law; nor deny to any person within its jurisdiction the equal protection of the laws."

One of the most important limitations upon the power to regulate grows out of this amendment: "It is the established law of the United States that this amendment prohibits the states from imposing upon public utilities schedules of rates which will not afford a fair return on the present fair value of the property used or useful in the rendition of the service for which the rate in question is charged." This rule was originally established by a very

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday July 19	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	115½	112	115½
Kansas Gas & Elec., 7% pf.	f105½	103	107
Kentucky Hydro-Elec., 7% pf.	m 97	94½	97½
Kentucky Sec.,6% pf.	k 86	83	87
Kentucky Secs., 5% com.	109	110	115
Kentucky Utilities, 6% pf.	100	95	98½
Keystone Pwr. & Lt., 7% pf.	102	96½	100½
LACLEDE GAS LT., 12% com.	k240	173½	267½
Lehigh Pwr. Sec., com.—no par	17½	15	20
Long Island Ltg., 7% pf.	109	107	112
Long Island Ltg., com.†—no par	142	139	153
Los Angeles Gas & Elec., 6% pf.	k102	98	100½
Louisville Gas & Elec., cl. A. $1.75	26½	23½	27½
MAN. ELEC. SUPPLY, cap. $5 —no par	106½	53½	106½
Manila Elec., com.†—no par.	k 42½	40	46
Maytag Mfg., com. .50—no par	29½	23½	32½
Memphis P. & L., pf.—$7—no par	108	107	109
Metropolitan Ed., pf.—$6—no par.	98½	93	100
Metropolitan Ed., pf.—$7—no par.	107	104	108
Metropolitan Ed., com. $5—no par.	67	....	....
Middle West Utilities, 7% pf.	a110	105½	113½
Middle West Util., 8% pr. lien	a120½	117½	122½
Middle West Util., com. $6—no par	a111½	108	117½
Midland Utilities, pr. in. 7% pf.	a104½	92½	104½
Midland Utilities, 7% pf. A	a101	98	106
Milwaukee Elec. Ry. & Lt., 7% pf.	k102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98½	98	101½
Minn. Pwr. & Lt., 7% pf.	f105½	104	107
Miss. Pwr. & Lt., $8 pf.	m114	106	111
Miss. River Pwr., 6% pf.	101½	94	97
Miss. River Pwr. 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7 —no par	106	100	109
Mohawk Hudson Pwr., 2d pf.—$7 —no par	100	98	109
Mohawk Hudson Pwr., com.—no par	24½	20½	27
Montana Pwr., 7% pf.	m121½	118½	123
Montana Pwr., 5% com.	103	81½	104½
Montreal Pwr., 7% com.	f 82½	....	....
Mountain States Pwr., 7% pf.	99	97	101
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	106	98	105
National Carbon, 8% pf.	a136	130½	137½
National Elec. Pwr., A†	a 24½	23½	25½
National Lt., Ht. & Pwr., com.	24½	....	....
National, Light, Ht. & Pwr., 5% pf.	70	....	....
National Pwr. & Lt., pf.—$7—no par	107	101	108½
National Pwr. & Lt., com.†—no par.	22	19½	23½
National Pub. Serv., 7% pf.	97	93	100
National Pub. Serv., 7% pfc., pf.	113	108	115
National Pub. Serv., A com. $1.60— no par	22½	18½	24
National Pub. Serv., B com.—no par	18½	14	20½
Nebraska Pwr., 7% pf.	f108½	106	108½
Nevada-Calif. Elec., com.	m 26½	25	31
New Brunswick Pwr., 4% pf.	55	....	....
New Eng. Pub. Serv., pr. in. pf. $7..	100	98½	101
New Eng. Pub. Serv., pf. $7.	97½	95	97½
New Orleans Pub. Serv.—7% pf.	103	103	105½
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	91	95
N. Y. Central Elec., 7% pf.	101	102	104
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf	109	....	....
Niagara Falls Pwr., 7% pf.—25.	28½	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110½	113
No. Amer., 6% pf.—50.	k 51½	50	52½
No. Amer., com.—10	48	45½	52½
No. Amer. Edison, $6 pf.—no par.	k101½	96½	101½
No. Caro. Pub. Serv., pf.—$7—no par	102	93	102½
Northeastern Pwr., com.	19	14½	20½
No. Indiana Public Service, 7% pf. A.	103	102	104
No. N. Y. Utilities, 7% pf.	105½	103	109
No. Ohio Pwr., com.—no par.	12	9½	13½
No. Ohio Trac. & Lt., 6% pf.	m 83	78	81
No. Ohio Trac. & Lt., 7% pf.	m 93	90	93
No. Ont. Lt. & Pwr., 6% pf.	k 91	84	95
No. Ont. Lt. & Pwr., 4% com.	74	73	78
No. States Pwr., (Del.) 7% pf.	104	101	107½
No. States Pwr., (Del.) 8% com.	118	109½	124
No. Texas Elec., 6% pf.	65	65	70
No. Texas Elec., com.	23	27	36
OHIO BRASS, com. B $4—no par.	82	74	85
Ohio Brass, 6% pf.	105	100	105
Ohio Pwr., 6% pf.	102	96	103
Ohio Pub. Serv., $6 pf.	98	95	96½
Ohio Pub. Serv., 7% pf.	106½	103	109
Ohio River Edison, 7% pf.	108	103	109½
Oklahoma Gas & Elec., 7% pf.	100	...	....
PACIFIC GAS & ELEC., 6% pf.	26½	24½	26½
Pacific Gas & Elec., 8% new com.	37	31	39½
Pacific Pwr. & Lt., 7% pf. ex. div.	f104	102	104
Penn Cent. Lt. & Pwr., $5 pf.—no par	c 76½	71½	76½
Penn-Ohio Edison, 7% pf.	k101½	97½	104½
Penn-Ohio Elec., 7% pf.	99	98	100
Penn-Ohio Pwr. & Lt., 7% pf.	101	99	103
Penn Pwr. & Lt.—$7—no par.	k108½	107	108½
Penn Wtr. & Pwr., 8% com., new.	e 54	47½	54
Phila. Co., 6% pf.—50.	c 52	49½	52½
Phila. Co., com.—50.	a104½	98½	110
Phila. Elec., 8% com.—25.	c 50½	46½	54
Portland Elec. Pwr., 7% pf.	98	97½	101
Portland Elec. Pwr., 6% pf.	77	78	83
Portland Elec. Pwr., 6% 2d pf.	55	55	70
Portland Elec. Pwr., com.	26	22	30
Potomac Elec. Pwr., 6% pf.	f108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m 79	....	....
Pwr. Sec., pf.—no par.	k 28	28	33
Pwr. Sec., com.—no par.	k 6	5	8
Public Serv. of Colorado, 7% pf.	f100	....	....
Pub. Serv. of N. J., 6% pf.	k100½	98½	101½
Pub. Serv. of N. J., 8% pf.	k130	125	132
P. S. of N. J., $2 com.—no par.	41	32	45½
Pub. Serv. of No. Ill., 6% pf.	a102½	101½	105½
Pub. Serv. of No. Ill., 7% pf.	a117	112½	117
P. S. of No. Ill., com. $8—no par.	a139½	130½	143
Pub. Serv. of No. Ill., $8 com.	a141	132	142
Pub. Serv. of Okla., 7% pr. in.	100	99	100½
Pub. Serv. Elec. & Gas, 6% pf.	107	102	108½
Puget Sound Pwr. & Lt., 7% pr. pf.	107½	105	107
Puget Sound Pwr. & Lt., $6 pf.—no par	87	....	....
Puget Sound Pwr. & Lt., com.	33½	28	35½
RADIO CORP. OF AMER., $3.50 pf.—50	51½	49	59½
Radio Corp. of Amer., com.—no par.	58½	41½	56½
Republic Ry. & Lt., pf.	k120	....	....
Republic Ry. & Lt., com.	k135	112	135
Rochester Gas & Elec. 6% pf. D.	k104	101	103½
Rochester Gas & Elec., 7% pf. B.	107	105	107
Rochester Gas & Elec., 6% pf. C.	104	101½	103½
SAFETY CABLE, com. $4	73	52½	73½
San Joaquin Lt. & Pwr., 7% pr. pf.	106	105	108
St. Joseph Ry., L., H. & P., 6% pf.	k 72	70	73
Servel Corp.	k 1½	1	10½
Sierra Pacific Elec., 2% com.	m 26	26	28½
Sioux City Gas & Elec., 7% pf	102	99	104
Southeastern Pwr. & Lt., pf.—$7 no par	f104	....	....
Southeastern Pwr. & Lt., ptc. pf.	f 78½	....	....
Southeastern Pwr. & Lt., com.—no par	35½	29½	38½
So. Calif. Edison, 8% pf.	38	36½	38
So. Calif. Edison, 7% pf.	k 29	27½	28½
So. Calif. Edison, 6% pf.	k 26	24½	27
So. Calif. Edison, 3% com.	35½	31½	36½
Southern Cities Utilities, 7% pf.	k 74	75	86½
Southern Cities Utilities, com. $4.	m 37	....	....
Southwestern Lt. & Pwr., A $3.	63	60½	65
Southwestern Lt. & Pwr., B.	63	60	65
Southwestern Lt. & Pwr., $6 pf.	85½	83	91½
Southwestern Pwr. & Lt., 7% pf.	k108½	103	110½
Springfield (Mo.) Ly. & Lt., 7% pf.	102	95	102
Standard Gas & Elec., 8% pf.	62½	57½	64
Standard Gas & Elec., 7% pr. pf.	106	103	110
Standard G. & E., com. $3.50—no par	62½	54	65½
Standard Pwr. & Lt., 7% pf.	102	98	102½
Staten Island Edison, pf.—$6—no par	100½	99	101
Superheater, $6 com.—no par.	172	170	185
Syracuse Lighting, 7% pf.	105½	103	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, 8% com.—no par	300	....	....
TAMPA ELEC., com. $2	60½	49	64
Tenn. Elec. Pwr., 6% pf.	96½	92	97½
Tenn. Elec. Pwr., 7% pf.	106½	103	106
Terre Haute, Ind. & East. Trac., 5% pf.	26	20	25
Terre Haute, Ind. & East. Trac. com	1	1	3⅜
Tex. Pwr. & Lt., 7% pf., ex. div.	f107½	106	108½
Tide Water Pwr., 8% pf.	107	105	109
Timken Roller Bear., com.—$4 no par	111½	78	111½
Toledo Edison, 8% pf.	115	115	118
Toledo Edison, 7% pf.	f106½	....	....
Toledo Edison, 6% pf.	98	95	97
Toledo Edison, 6% com.	98	....	....
Tri-City Ry. & Lt., 6% pf.	97	90	97
UNITED GAS & ELEC., 7% pf.	100	98	102
United Gas & Elec., com.—no par.	m 57	....	....
United Gas & Elec. (N. J.) 5% pf.	70	70	73
United Gas Impr., 8% com.—50.	c105½	89½	108½
United Lt. & Pwr., pf.—$4—no par.	57	50½	53½
United Lt. & Pwr., pf.—$6.50—no par	95	87	97½
United L. & P., com. A .48—no par.	13	12	15½
United L. & P., com. B .48—no par.	a 18	15	18
Utah Pwr. & Lt., 7% pf.	f 107	104	108½
Utica Gas & Elec., 7% pf.	105	105	106½
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	95½	93	100
Utilities Pwr. & Lt., com. A $2.	31	27	34
Utilities Pwr. & Lt., com. B $1—no par	17½	13½	19
VERMONT HYDRO-ELEC., 7% pf.	98	95	99
Virginia Elec. & Pwr., 7% pf.	107	105	107
Virginian Pwr., 7% pf.	108	....	....
Virginian Pwr., com.	74	....	....
WAGNER ELEC., 7% pf.	b 88	68	90
Wagner Elec., com.—no par.	b 32	18½	39½
Washington Ry. & Elec., 5% com.	f256	....	....
Washington Ry. & Elec., 5% pf.	f 91½	....	....
Washington Wtr. Pwr., 8% com.	160	136	168
West Penn Elec., 7% pf.	111½	102	111½
West Penn Elec., Cl. A $7.	k108½	97½	110
West Penn Pwr., 7% pf.	115	111	118
West Penn Pwr., 6% pf.	104½	100½	108½
West Virginia Lt., Ht. & Pwr., 7% pf.	90	94	96
West Va. Utilities, 7% pf.—50.	51½	48	51
Western Pwr., 7% pf.	k 99	98	101½
Western States Gas & Elec., 7% pf.	100	96	100½
Western States Gas & Elec., com.	24	....	....
Westinghouse Elec. & Mfg., 8% com. —50	86½	67½	86½
Weston Elec. Instrument, Cl. A $2 —no par.	k 31	30½	34½
Weston Elec. Instrument, com.—no par.	k 14	13½	18½
Wheeling Elec., 6% pf.	100	95	97
Worthington Pump, 7% pf. A.	k 54	46	61½
Worthington Pump, 6% B.	k 48½	40	54½
Worthington Pump, com.	39	20½	46
YALE & TOWNE com. $5—25.	k 81	70½	81

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, July 16. *l*Bid price Wednesday, July 20. *m*Latest quotations available. †Dividend rate variable.

narrow margin, but it is now settled by an overwhelming weight of authority. Note that this constitutional provision is not a guaranty of any return. It is not the basis of the right to earn. This right is an incident of ownership. What the constitution does, and all that it does, is to limit the power of the states to interfere with this right to earn by prohibiting them from imposing confiscatory rates.

There is no legislation in Massachusetts nor could there be that would deprive the utilities of their constitutional right to a fair return upon fair value of the property devoted to a public use; and upon all of that property, irrespective of how capitalized and irrespective of the fact that the property may be paid for in part out of past earnings.

The premium law of Massachusetts cannot eliminate these legal rights. The elimination of the premium law will not therefore sacrifice any right which the public or the state now has under the laws of Massachusetts.

"All earnings of the utility belong to it, and if the earnings or part thereof have been invested in new property it is the property of the utility upon which it is entitled to earn. It is immaterial whether the rates in the past have been excessive or low; the earnings belong to the utility even though the rates charged may have been high, and if the rates were low and the utility has suffered a loss it cannot now constitutionally charge excess rates to make up for that loss.

"Constitutional protection against confiscation does not depend on the source of the money used to purchase the property.

"Board of Commissioners vs. New York Telephone Co. 271 U. S. 31. Newton vs. Consolidated Gas Co., 258 U. S. 165, 175. Galveston Elec. Co. vs. Galveston, 258 U. S. 388, 395. Georgia Ry. vs. Railroad Commission, 262 U. S. 625, 632."

PROPOSED LEGISLATION

Senate bill 170 proposes to authorize the issue of additional shares at par to equal the premiums already paid by the stockholders, provided a majority of the stockholders vote in favor thereof. The total par value of securities, however, is not to be greater than the structural value of the plant and the land. New shares will be issued to individual stockholders in proportion to present ownership of shares. The effect of this will be largely to correct a state policy found to be erroneous and impracticable. It will correct it as to the past and eradicate it as to the future. A majority in interest of the stockholders must vote in favor of such action.

A short analysis of the effect of the act will show that it works no injury to any stockholder. The principal rights of the stockholder are, first, the right to participate in the selection of officers; second, the right to share in distribution of profit and surplus; third, the right to share in all assets upon dissolution. Each one of the above rights is now controlled solely by the number of shares owned by each stockholder and in no way depends upon what he paid for the stock, whether he bought it in the open market or as a stockholder at a premium. The new shares that will be issued will be distributed to the owners of stock in proportion to the number of shares owned, regardless of any premiums paid. The distribution of such shares on this basis will leave the rights of the stockholder as to control of the election of officers, as to sharing in dividends or in assets upon dissolution exactly where he stands at present. He will get exactly the same proportionate shares of dividends after this issue is made as he receives under his present stock holdings. Furthermore, it does not take any money or rights from the public.

As under the proposed law the comparative rights of present stockholders are not changed in the slightest degree by the issuance of the new stock, there cannot be the least inequality or the least injustice to any stockholder, and such action will in part, at least, correct an anomalous, unsatisfactory and uneconomic situation. And in so far as it will bring a greater correspondence of par value of securities to cost or value of property, it will relieve a situation leading to misunderstanding and criticism.

CAPITALIZATION OF SURPLUS

I have been discussing the proposed capitalization at par of previously acquired premiums. Going beyond this, it is respectfully suggested that the public interest would be served were the utilities permitted to issue within reasonable limitations stock or securities at par against surplus.

The existence of a very large surplus must of necessity and rightfully lead to dividends larger in proportion to the par of securities outstanding than would be the case where the par of securities outstanding more nearly equaled the cost or value of the property. The existence of some reasonable surplus is, however, justified and a mark of conservative management. A law authorizing the capitalization at par of unnecessary surplus would tend to bring about a closer harmony between par of securities and the cost and value of the property. It will keep the earnings in the company rather than force distribution. The existence of some surplus would tend, of course, if the company is earning fairly under reasonable rates, to maintain the market value of the stock somewhat above par. Manifestly, the market value of any stock will fluctuate, and it is much better that the stock should have a market value somewhat above par and it is well that the company shall have sufficient surplus to assure a stable condition in times of depression or adversity. But within proper limitations, the issuance of securities along this line would appear to be in the public interest.

Three New Offerings Made

A substantial issue of the week ended July 21 was the ten-million-dollar offering of the Union Electric Light & Power Company of Missouri, placed privately. Proceeds will be used to reimburse the company for expenditures made for additions and extensions to plant.

General and refunding mortgage gold bonds, series C, of the Detroit Edison Company to the amount of $20,000,000 were offered during the week under review, the price being 102¼ and interest, yielding over 4.85 per cent. These bonds, dated Oct. 1, 1924, and maturing Aug. 1, 1962, are secured by a direct mortgage on the entire fixed property and franchises of the company and in addition are secured by the deposit of $12,500,000 first and refunding mortgage bonds.

The third new issue was a Canadian offering — a $1,500,000 issue of the Manitoba Power Company, Ltd., in the form of first mortgage 5½ per cent sinking fund gold bonds. These securities, guaranteed as to principal and interest by indorsement by the Winnipeg Electric Company, were priced at 99 and interest to yield 5.57 per cent.

Prospects of 80,000,000,000 Kw.-Hr. in 1927

The monthly report of the production of electricity by public utility power plants for May, issued by the Geological Survey, Department of the Interior, shows a total for the first five months of the year amounting to 32,400,000,000 kw.-hr., or about 9½ per cent more than the output for the same period in 1926. An estimate based on the output so far this year and on comparable figures for 1926 indicates that the total output for 1927 will be in the neighborhood of 80,000,000,000 kw.-hr. The total for 1926 was 73,800,000,000 kw.-hr.

The effect of the increasing hours of daylight and the rising temperature from the first to the middle of the year on the demand for electricity for light and heat is shown in the decrease in the average daily production of electricity that occurs during this period each year. This year the decrease in the average daily output from January to May was about 3 per cent; in 1926 the decrease was about 5 per cent; in 1925, 6 per cent. The Geological Survey suggests that the lessening of the decrease in 1927 may be due in part to the increasing load for electric refrigeration.

The average daily production of electricity by the use of water power in 1927 has set a record for each month from March to May. As the amount of electricity produced by water power is directly dependent upon the amount of water flowing in the streams used for the development of power, it is expected that the output will begin to decrease after the month of May, as March, April and May are generally months of maximum flow for streams in the United States.

Illinois Power & Light Corporation Calls Stockholders Meeting.—A special meeting of the stockholders of the Illinois Power & Light Corporation has been called by the board of directors for Aug. 15, for the purpose of increasing the authorized common capital stock from 400,000 shares without par value to 600,000 shares without par value, or to such other amount as the stockholders may determine, and to amend the certificate of incorporation and charter and by-laws of the company accordingly.

Manufacturing and Markets

Selling Motors and Control

Majority Opinion Is that Manufacturer with Thorough Knowledge of Control Apparatus Has Better Market Possibilities and Renders the Best Service

IMPORTANCE of control equipment in motor applications is recognized by most manufacturers of control apparatus, and such companies feel that generally motor manufacturers do not pay sufficient attention to the question of proper control in connection with a motor application, but are concerned almost wholly with selling a motor. This consensus of opinion was obtained following an editorial which appeared in the April 30 issue of the ELECTRICAL WORLD. The War Department specifications for motors and control state that "the motor and controller must be of the same manufacture." Such a position, of course, is undesirable as it eliminates the manufacturer who builds only one type of apparatus and limits competition, but it shows a recognition of the principle that in motor applications the problem of control is inseparably bound up with the motor operation.

VARIOUS COMMENTS OUTLINED

A controller company in its comments on the general situation says:

"The majority of motor manufacturers, particularly the motor manufacturer's salesman, have no other interest than selling a motor to a customer and apparently gives no consideration to the fact that only the correct type of control apparatus will give the customer general satisfaction. The motor may be 100 per cent satisfactory, but if the wrong type of control apparatus is used, the entire electrical installation may be "damned" by the customer. Frankly, the general ignorance on the subject of control equipment among motor salesmen is rather appalling, when one considers how essential proper control equipment is to the satisfactory operation of the motor. On the other hand, we find that the majority of the motor salesmen who can be labeled wide-awake have discovered the important function that the proper control device plays in an electrical installation, and it is our opinion that a good portion of these men's success is owing to the fact that they sell the customer not a motor, but a unit consisting of motor and control that will satisfactorily perform the functions required of it.

"So long as the motor manufacturer or his representative considers the control device an incidental to the motor installation, the customer will not receive the benefit of the full engineering knowledge and experience that the motor salesman should have. If anything, the control required for any given job deserves at least as much, if not more, study than the motor itself. The ultimate customer will be benefited if the motor salesman tries to learn as much about control apparatus as possible, while the control manufacturer should also know as much about motor applications as he can learn."

ACTUAL CASES CITED

Another controller manufacturer says: "In our experience this theory works out in actual practice. We have had men who left this company and who had controller training who have developed into very fine motor salesmen because of their knowledge of control, which necessarily means motor application. In fact, a man whom I consider quite outstanding as a motor salesman in this country has told me that he sells 90 per cent of his motors on control, in other words, on application. He was connected with a controller manufacturing concern for about eight years before going into the motor business. We have been trying to educate the motor manufacturer to an appreciation of the control equipment in a motor application."

A third controller manufacturer says: "Motors have become so standardized in construction and so competitive in cost that any reputable manufacturer can supply a motor suitable for any application. The best sales argument that the motor manufacturer's representative has left to offer is the question of service, and this is not only construed to mean service on the equipment after it has been installed, but service in solving problems in making the actual sale.

CUSTOMER ATTITUDE IMPORTANT

"It would appear that the customer would be better satisfied and more favorably inclined to the particular representative who could not only present the complete story on motors but also supply additional information on control, giving the customer a completed proposition rather than half a solution. Most of the motor manufacturers have recognized this, so that it has become almost a universal practice for the motor men to talk control as well as motors. It is regrettable that there are still some motor manufacturers who persist in a policy that basically is not conducive to the most satisfactory business relations. While the above procedure is undoubtedly of aid to the control manufacturer, nevertheless, the control manufacturer as a rule is required to sell motor application as well as control application, in order to receive any consideration from the customer."

The motor manufacturers' comments were as follows:

(a) "While this company may not follow the correct course in every instance, we strive for it and frequently impress our sales force with the importance of having the equipment completely satisfactory to the customer. There are many instances where the control equipment we furnish is a big factor, if not the controlling factor, in our securing the business."

(b) "That manufacturer is most successful who renders the best service to his customers. In order to render the best service it is necessary to know the duty to which a motor is to be put. He must know that the characteristic of the motor is such that it will fit the duty for which it is intended. He must also know the type of control which is necessary so that the motor can perform its duty successfully. This means that in many cases it is finally necessary for the motor manufacturer to furnish the control or see that the proper control is furnished. In any case, we believe that a thorough knowledge of control is not only desirable for the motor manufacturer, but very necessary."

SALESMEN TRAINED TO STUDY CONTROL

(c) "All of our salesmen are application engineers and know that in any application problem the control is just as important as the motor in permitting a satisfactory solution."

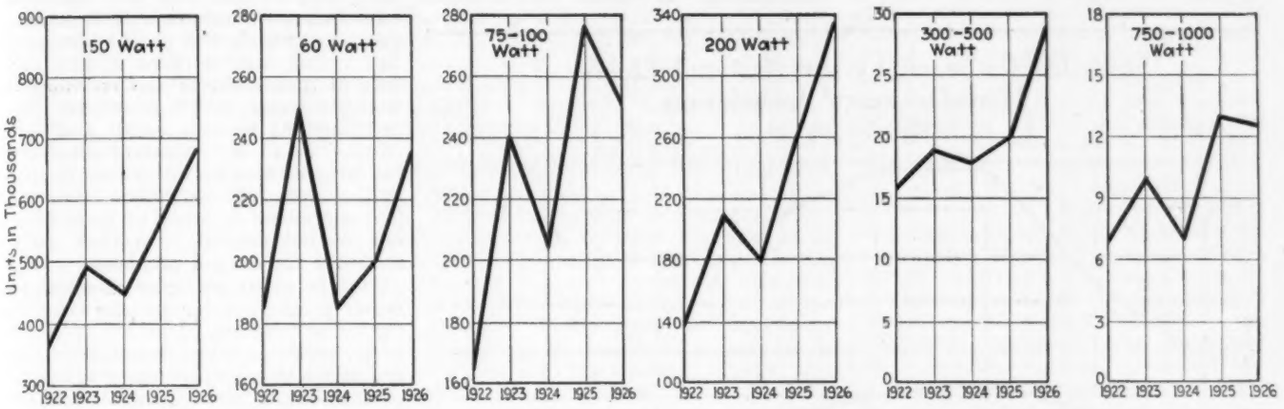
(d) "In our own case we do not often get up against the control situation, because the majority of our motors are thrown directly across the line. We list automatic controllers of the proper type in our price book and are in shape to give the buyer any information he wants relative to controls that are suitable for our motors. We believe that every motor manufacturer should give this situation considerable attention."

A motor manufacturer who builds fractional-horsepower motors which do not as a rule require controllers has the following viewpoint: "In general, we feel that the motor and the controller should be bought from experts in the two lines, usually not the same people, or, even if the same company, they are entirely separate departments and it is up to the customer to specify his requirements both for motor drive and control. It is also very desirable that the controller manufacturer should have data as to the performance of the motor, that is, a complete set of curves."

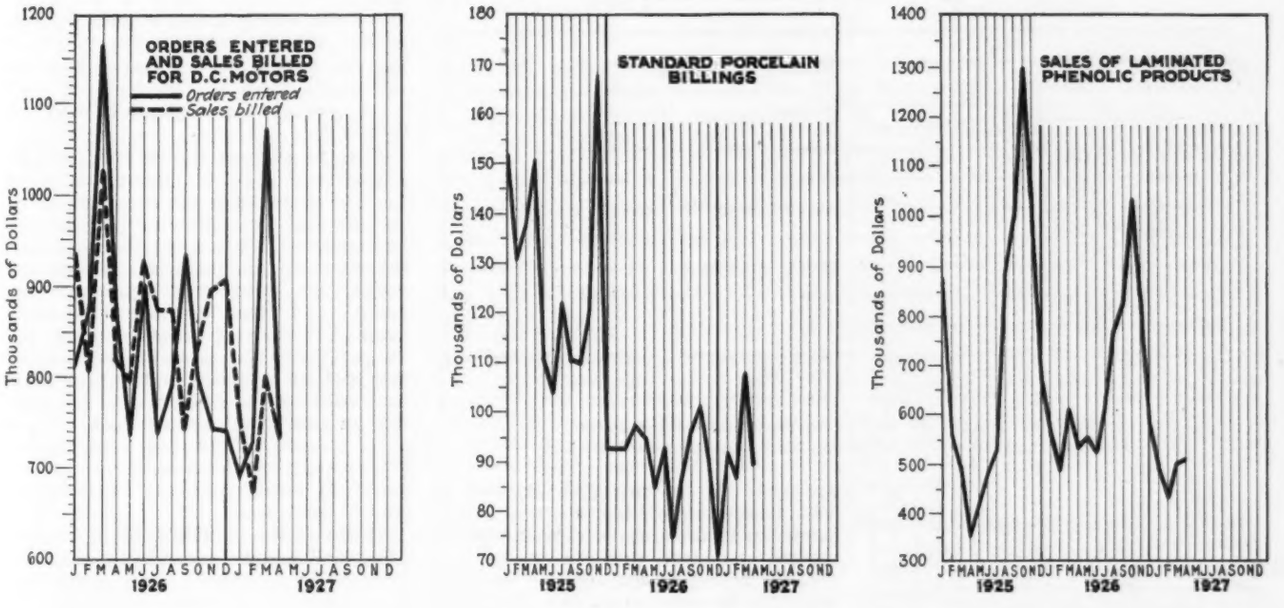
A controller manufacturer who takes a slightly different viewpoint discusses the subject at length. He says. "It is my opinion that the motor problem and the control problem on an installation are two different issues, and in order to secure the most satisfactory results they should be separated. It is perfectly feasible, of course, for a motor manufacturer's salesman to sell with his motor a standard stock controller

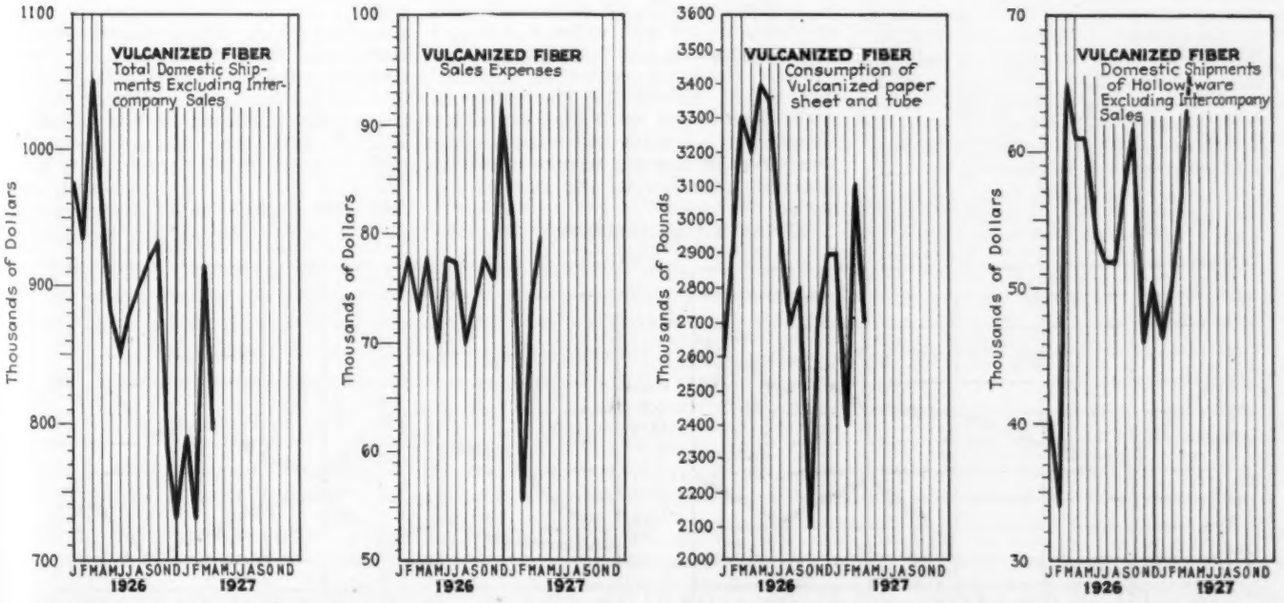
Statistics Gathered by the National Electrical Manufacturers' Association

(See also page 194)



INDUSTRIAL LIGHTING REFLECTORS BY WATTAGES. THESE CURVES CLEARLY INDICATE THE INCREASING APPRECIATION SHOWN BY INDUSTRY IN BETTER ILLUMINATION.


ORDERS ENTERED AND SALES BILLED FOR D.C. MOTORS
Orders entered
Sales billed
STANDARD PORCELAIN BILLINGS
SALES OF LAMINATED PHENOLIC PRODUCTS
Thousands of Dollars
J F M A M J J A S O N D J F M A M J J A S O N D
1926 1927
1925 1926 1927


VULCANIZED FIBER
Total Domestic Shipments Excluding Intercompany Sales
VULCANIZED FIBER
Sales Expenses
VULCANIZED FIBER
Consumption of Vulcanized paper sheet and tube
VULCANIZED FIBER
Domestic Shipments of Hollowware Excluding Intercompany Sales
Thousands of Dollars
Thousands of Pounds
J F M A M J J A S O N D J F M A M J J A S O N D
1926 1927

STATISTICS COVERING DIRECT-CURRENT MOTORS, STANDARD PORCELAIN, LAMINATED PHENOLIC PRODUCTS AND VULCANIZED FIBER

such as a compensator or across-the-line switch or a direct-current starter, but when it comes to the motor manufacturer's salesman attempting to sell a piece of control apparatus which is at all complicated with his motor, I think this is another proposition.

"The application of suitable control, particularly in the more complicated installations, is quite an intricate problem. It is very difficult, and in fact almost impossible, for any motor salesman to understand thoroughly the control problem and to make the proper recommendations for suitable control. In order to do this the motor manufacturer's salesman would have to be familiar with all of the different switches, relays and other equipment manufactured by the controller builder and how these are combined. In itself this would necessitate his being in very close touch with the controller company at all times and in such close touch that he may not be able to devote suitable attention to the sale of his motor.

"If the motor manufacturer's salesman has not this information at his command, it is necessary for him to obtain it from the controller builder or the controller manufacturer's salesman, and in this way the controller manufacturer's salesman first explains and recommends the proper control to the motor manufacturer's salesman, who in turn explains and recommends it to the buyer, which, of course, is increasing the sales expense and sales effort. It is my understanding that the large companies which manufacture both motors and controllers have control specialists in many of their offices and do not depend upon their motor salesman for control problems.

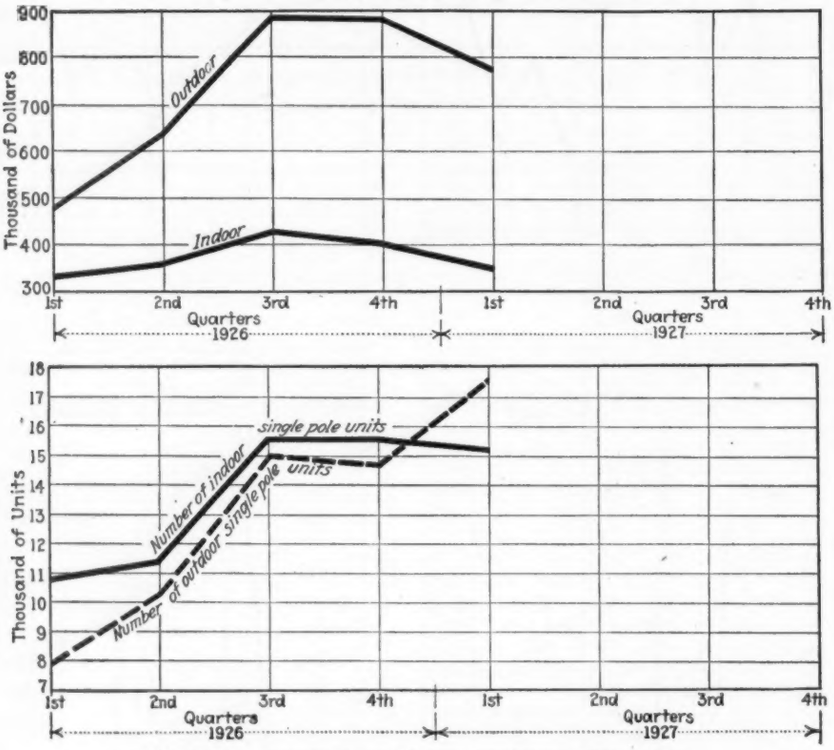
"In the great majority of cases the motor problem is far simpler than the controller problem. In other words, it is far easier to select a suitable standard or adopt a special motor to accomplish a certain result than it is properly to recommend suitable control where requirements involve relays, switches and other apparatus to accomplish the result. It seems that a controller salesman selling a motor with his controller possibly requires less engineering knowledge of the motor builder's apparatus than if the motor builder were selling the controller with his motor.

"Let us assume that a combined installation is sold to a manufacturer of machinery using a direct motor drive. In this case the following profits must be considered: the controller manufacturer's profit, the motor manufacturer's profit, the machinery manufacturer's profit and the machinery dealer's profit. If each of these profits is but 10 per cent, the total amounts to 40 per cent of the cost, and it is a question whether the consumer is not paying an exorbitant selling cost. Moreover, a cost of 10 per cent hardly seems sufficient to a motor manufacturer to cover his cost of handling control equipment.

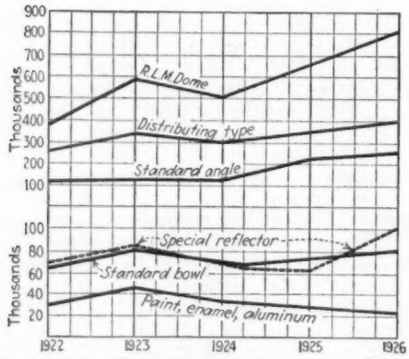
"I am of the opinion that the selling of control apparatus with a motor has been owing to some extent to the fact that a few of the large companies are manufacturing both motors and controllers and are in a position to make a combined bid. The smaller manufacturer, who does not build controllers, feels that his position is strengthened by also making this combined bid, or the purchaser insists on the combined bid. I feel that if the consumer realized that motors and controllers are two very distinct problems, and that even though both of the classes may be built by one of the larger com-

Statistics Gathered by the National Electrical Manufacturers' Association

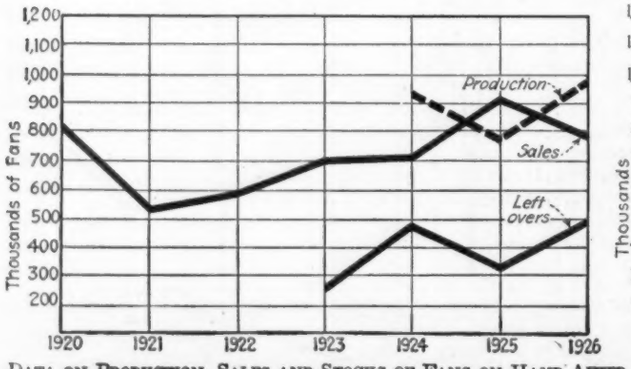
(See also page 193)



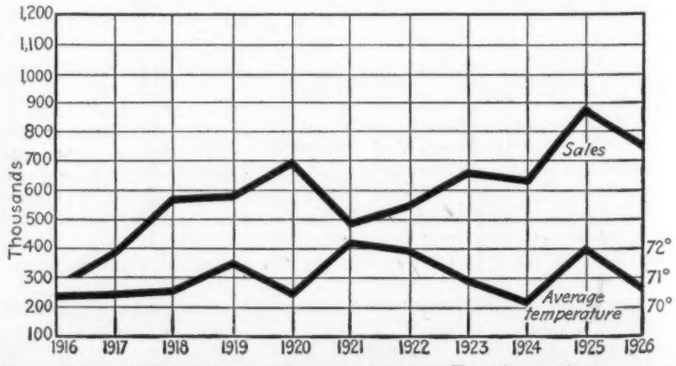
QUARTERLY STATISTICS OF POWER SWITCHING EQUIPMENT
(Exclusive of oil circuit breakers, switchboards and fuses.)



INDUSTRIAL LIGHTING REFLECTORS BY TYPE OF FIXTURE. USE OF THE RLM DOME STEADILY INCREASES.



DATA ON PRODUCTION, SALES AND STOCKS OF FANS ON HAND AFTER THE SELLING SEASON WILL AVOID OVERPRODUCTION



AVERAGE TEMPERATURE PLOTTED AGAINST FAN SALES SHOW THAT THERE IS NO RELATION BETWEEN THE TWO

panies, they are handled in separate departments by separate engineering forces, and at times sold by different salesmen, and that there is little, if any, advantage in securing a combined bid, there would then develop a more satisfactory situation for the motor manufacturer. Of course, while the condition exists that the motor manufacturer, owing to the competitive situation, must make a combined bid, it is desirable for a salesman to be familiar as possible with control apparatus."

Canadian Government Adopts Electrical Code

A Canadian electrical code has been adopted as a result of a meeting of representatives of all the Canadian provincial governments at Winnipeg on June 15 to 20. This meeting was the culmination of more than two years work looking toward the development of a Canadian electrical code. The code is now being printed and will be published at an early date. It is said to be generally harmonious with the National Electrical Code in many of its provisions in form and substance and the Canadians are expecting to perfect their relations with those concerned in making the National Electrical Code so that in future editions the approach between the two codes may be closer and may lead to the formation of an international electrical code. It is believed that some of the advanced developments in the Canadian electrical code will be helpful in the further development of the National Electrical Code.

Business Conditions

BUYING in the electrical industry is on a fairly steady basis. A number of inquiries now in the market presage good future business and everywhere electrical men are optimistic that at least there will be no decline in sales for the second half of the year. Central-station companies have been placing orders in line with their budgets which showed a 12 per cent increase over the buying of 1926.

In New England heating equipment sales were active. Motor buying has continued at the same rate, with machine tool builders placing many orders. In New York central-station inquiries have increased considerably, although no material business has yet been placed. A large power transformer order, amounting to $175,000 was placed in the Southeast, and electric and gas self-contained railway cars amounting to $100,000 were purchased. General business, however, is quiet in the Southeast. Buying in the St. Louis district is improving steadily. Little change is noted in the Middle West, but the forecast is optimistic. On the Pacific Coast railroad companies have been active buyers and a large order for motors was placed by a pulp and paper company as the initial purchase of electrical equipment for a four-million-dollar plant.

Non-Ferrous Metal Market Active—Prices Increase

Improvement in all of the major non-ferrous metals has occurred. Buying has been active, particularly in copper, zinc and lead, and consumers have bought tin in good volume. A factor in the strength of the domestic copper market was the unusually active buying abroad, particularly in the case of Germany.

NEW YORK METAL MARKET PRICES

	July 13, 1927 Cents per Pound	July 20, 1927 Cents per Pound
Copper electrolytic	12.66	12¾
Lead, Am. S. & R. price	6.20	6.30
Antimony	11¾	11¾
Nickel, ingot	35	35
Zinc spots	6.50–6.55	6.65
Tin, Straits	64¼	64
Aluminum, 99 per cent.	26	26

Base copper price July 20, 1927, 14¼ cents.

Heating Equipment Sales Active in New England District

Industrial heating equipment sales have been prominent in the New England market. A twenty-thousand-dollar electric furnace order was placed by a Greenfield (Mass.) industrial concern, a two-thousand-dollar sale was made to a Worcester (Mass.) factory, a 45-kw. pot was purchased by a Portland newspaper and a 300-kw. baking oven will shortly be purchased for use in Boston. Motor sales are as large as they were in the previous week and machine tool builders are reported as good buyers. Lamp sales are unusually active. Inquiries for industrial equipment are in good volume and jobber sales, while a little off, are not by any means poor.

Large Power Transformer Order Placed in Southeast

General activities in the Southeast remain somewhat quiet, though several individual large orders were placed. A company in Louisianna purchased large power transformers amounting to $175,000 and a steam railway company ordered $100,000 worth of electric and gas self-contained railway cars. A central-station company ordered switching equipment amounting to approximately $21,000 and watt-hour meters totaling $5,650. Line construction activities continues to be reflected in the movement of line construction materials. An order for an electric welder costing $2,000 was also placed. Merchandise activities of the larger power companies are sustaining the demand for ranges, refrigerators, flat irons and fans, all of which are moving briskly. One power company closed orders recently on an apartment house installation for 36 electric ranges, 36 refrigerators and 36 electric logs.

Inquiries Increase Considerably in New York District

A considerable increase in inquiries from central-station companies in the New York district is reported, although actual sales have not yet materialized. Inquiries covering switching equipment are increasing and one manufacturer reports sales so far this year about equal to the same period last year. Sales of poles, crossarms and hardware have shown a little increase, but individual orders are small in virtually all instances. Small and medium-sized motors are finding a good market among industrial purchasers. One manufacturer of motors reports a slight increase of sales during the past six months as compared with the same period in 1926. Jobbers note a decrease in the demand for general materials and appliances, except fans, which recently have been in good demand.

Little Change in Middle West—Forecast Optimistic

Little change in general business conditions is noted in the Middle West. It is generally felt that the worst period of the year has been passed and that business should improve during the last half of the year. Quarterly reports for the period ended July 1 in many cases show a gain, although not large. The various utility companies are in good shape. More construction work is being started and considerable apparatus is being purchased. Interesting orders placed included a 400,000-volt "kenotron" cable testing set, three 43,000-kva., single-phase, 60-cycle, oil-insulated reactors, seven high-speed, single-pole, hand-operated disconnecting switches, 985 direct-current watt-hour meters and 500,000 lb. of weatherproof wire. Jobbers report a fair volume of business.

Railroad Companies Active Buyers on the Pacific Coast

Railroad companies have been buying heavily this month on the Pacific Coast after a quiet six-months period. A lamp contract involving $125,000 was placed by the Southern Pacific Railroad with the General Electric Company. Machinery orders have included nine current-limiting reactors amounting to $10,000, $2,000 worth of transformers for a gravel company, $2,500 worth of motors for Hawaiian dealers and about $8,000 worth of switchboards. Special inquiries have included a request for quotations on 200,000 ft. of No. 18 lamp cord and 500,000 ft. of rubber-covered wire. A San Francisco hotel plans to spend $250,000 for new elevators and other additions. Steamer rates via the Panama Canal are increasing from 25 per cent to 100 per cent, effective Aug. 1.

The Washington Pulp & Paper Company has purchased from the Westinghouse Electric & Manufacturing Company 1,500 hp. in motors and from the Allis-Chalmers Manufacturing Company 3,500 hp. in motors as the initial order for its four-million-dollar paper mill at Port Townsend. Seattle jobbers report good sales of small-sized motors to out-of-town distributers. Other motor orders include two 400-hp.

units for a 50-ton electric hoist for the city of Seattle and two 75-hp. and three 7½-hp. motors for a paper mill in Tacoma, three 30-hp. motors for a plant at East Washington and ten miscellaneous units for other industrial plants.

Buying Improves Steadily in St. Louis District

Conditions in the St. Louis district are improving steadily. The city has placed an order for a service power and lighting switchboard to be used at the Howard's Bend pumping station at a total installed cost of $15,000. A local power company purchased a 2,500-kw. turbo-generator unit with condenser at a combined cost of $55,000. Another local company bought $10,000 worth of medium-sized transformers. A contract, amounting to $100,000, was awarded for electric elevators to be installed in an office building now being erected. The activity previously reported in the oil fields in the southwestern part of the district continues. One order is reported for 40 oil well pumping motors, 15 hp. to 35 hp., to cost about $30,000 and inquiries have been received for figures on as many more. The demand for small and medium-sized motors for industrial uses has been steady and in better volume than in any previous period this year. Line construction material is active.

Activities of the Trade

Power Specialty and Wheeler Condenser Form Merger

The Wheeler Condenser & Engineering Company, Carteret, N. J., and the Power Specialty Company, 111 Broadway, New York, have concluded arrangements for consolidating their business in a New York corporation under the name of the Foster Wheeler Corporation. Through this merger the new corporation will have complete facilities for designing and building condensers, pumps, feed water heaters, pulverized coal equipment, water-cooled furnaces, superheaters, economizers, air heaters and other auxiliary machinery used in steam power plants, as well as oil refining equipment. The Foster Wheeler Corporation has issued 35,000 shares of 7 per cent cumulative convertible preferred stock (without par value). This stock is to be used in part to retire $2,771,600 preferred stocks of the two companies and in part to acquire the assets of the Wheeler Condenser & Engineering Company. The corporation will have no securities prior to the 35,000 shares of preferred stock and 194,000 shares of no par value common stock.

The new officers will be those of the old companies as follows: J. J. Brown, chairman of the board of directors; Pell W. Foster, vice-chairman and treasurer; L. B. Nutting, president; John Primrose, vice-president; H. S. Brown, vice-president; W. E. Dowd, Jr., vice-president; David McCulloch, secretary and general manager, and W. F. Keenan, Jr., chief engineer.

International Combustion and F. J. Lewis Company Consolidate

George E. Learnard, president of the International Combustion Engineering Corporation, New York, in a letter to the stockholders states that the F. J. Lewis Manufacturing Company, Chicago, and the International company have mutually agreed to consolidate their interests. The International company owns two processes for the low temperature distillation of coal. The board of directors deciding that it was very desirable for the company to construct, own and operate such plants throughout the country decided on the consolidation in order to complete the organization, plant facilities and technical knowledge necessary to carry out this additional new business. The Lewis company is known as one of the three large tar companies in the United States.

F. J. Lewis, chairman, and W. H. Lewis, president, respectively of the Lewis company, will continue in their present positions and that company will be operated as an independent unit without any changes. To provide for the acquisition of the stock of the Lewis company, for the construction of distillation plants and for additional working capital which will be required, the board of directors has recommended that 100,000 shares of preferred stock be authorized, and that the common shares be increased from 750,000 shares to 1,100,000 shares. The board proposes issuing immediately 50,000 shares of the preferred stock for cash.

Tipless Lamp Suit Finally Settled

In the United States Circuit Court of Appeals at Philadelphia it was decreed recently that Charles Eisler and the Eisler Engineering Company in their method of making tipless lamps did not infringe on the General Electric patent. The patent involved is the Mitchell and White patent issued on July 25, 1922. In rendering its decision the court referred to the Jaeger patent, issued in 1903, for making a tipless bulb and said " . . . we think that in all these functional steps the defendants' bulb is a functional approach to Jaeger and a functional departure from the patentee's. In view of these facts we are of opinion that to hold the defendants' structure an infringement would logically result in holding that, embodying as it does Jaeger's device, the latter anticipated Mitchell and White's patent."

But the court held that this was not the case and further stated that if the defendants' structure had antedated Mitchell and White's structure it would not have anticipated it. Regarding the machine patent which covers the apparatus for performing the process involved in the Mitchell and White patent the court held that there was no error in the court below in its holding the machine claims invalid.

General Electric Earnings Continue to Increase

Sales billed by the General Electric Company for the first six months of 1927, according to an announcement by President Gerard Swope, amounted to $149,795,026, compared with $147,450,867 for the corresponding period last year. The profit available for dividends on common stock for the first six months of 1927 was $22,542,972 compared with $19,000,392 for the same six months last year.

The statement of sales and earnings for the six months compared are as follows:

	1927	1926
Net sales billed	$149,795,026	$147,450,867
Less: Cost of sales billed, including operating, maintenance and depreciation charges, reserves and provision for all taxes	130,930,258	131,191,460
Net income from sales	$18,864,768	$16,259,407
Other income, less interest paid and sundry charges	4,965,394	3,811,516
Profit available for dividends	$23,830,163	$20,070,923
Less: Cash dividends on special stock	1,287,190	1,070,530
Profit available for dividends on common stock (7,211,481 84-100 shares issued)	$22,542,973	$19,000,393

The profit available for common stock is equivalent to $3.13 per share in 1927 and $2.63 per share in 1926.

The Maytag Company, Newton, Iowa, manufacturer of washing machines, on July 14 distributed about $150,000 among nearly 500 employees who had been with the company three years or more, in celebration of the seventieth birthday of F. L. Maytag, founder of the company and chairman of its board. The gifts in the form of savings accounts in a local bank were on a basis of $50 for each year of service with the company.

The Crocker-Wheeler Electric Manufacturing Company, Ampere, N. J., has declared a dividend of 1¾ per cent on its preferred stock payable July 23. The last previous payment on this stock was made on April 15, 1925.

The Frigidaire Corporation, Dayton, Ohio, announces a price reduction of $15 on its new model household electric refrigerator placed on the market two months ago. The new price will be $180 f.o.b. Dayton, Ohio. Price reductions affecting porcelain cabinets and commercial cooling coils also have been announced. A large cooling coil for high-duty commercial installations has been added to the line.

The Tar Products Corporation, 99 Empire Street, Providence, R. I., refiner and manufacturer of "Hexsulate" insulating compound, "Hexsote" wood preservative, etc., announces that it is now affiliated with the American Tar Products Company of Pittsburgh, Pa. The new officers of the company are: J. N. Forker, president; M. D. Gill and J. H. Readio, Jr., vice-presidents; W. G. Hunt, treasurer, and D. M. Gilmore, secretary. The company will continue to operate as the Tar Products Corporation, New England division of the American Tar Products Company.

New Trade Literature

SUPERVISORY CONTROL EQUIPMENT.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued special publication No. 1780, describing its new panel-mounted supervisory control equipment. This publication discusses synchronous visual-type control, the audible-type control, the medium-frequency type of control and the direct-wire control. Illustrations show the equipment and installations.

ARC WELDING.—"Modern Manufacturing with a 'Stable Arc' Welder" is the title of a booklet issued by the Lincoln Electric Company, Colt Road and Kirby Avenue, Cleveland. The booklet briefly outlines the theory of the use of arc welding in production manufacturing, with illustrations showing applications of the arc-welding process. The first section is devoted to the replacing of iron castings by standard rolled-steel sections joined by arc welding. Another section calls attention to arc welding in the tool room. It contains illustrations showing jigs, fixtures, punches and strippers which were made by arc welding and several types of "Stable-Arc" welding machines.

DIMMERS.—Bulletin No. 68 issued by the Ward Leonard Electric Company, Mount Vernon, N. Y., describes and illustrates the "Vitrohm" dimmers for the accurate control of lighting. It contains drawings showing typical forms of mounting framework and typical wiring diagrams. Specifications for a theater dimmer are included.

AERIAL POWER CABLE.—The Okonite Company, Passaic, N. J., is distributing a booklet entitled "Aerial Power Cable," in which it calls attention to the advantages of the Okonite aerial power cable for overhead construction. It contains illustrations showing various types of overhead lines using aerial power cable and also showing different methods of aerial cable construction.

ELECTRIC MOTORS.—Bulletin No. 144 issued by the Wagner Electric Manufacturing Company, 6400 Plymouth Avenue, St. Louis, covers the Flynn-Weichsel motors. Illustrations showing typical installations of the Fynn-Weichsel motors are given. Curves give the starting and running characteristics, and diagrams illustrate the starting and running connections. The overload characteristics are treated and a chapter is devoted to a discussion of the cost of Fynn-Weichsel motors.

CONDUIT FITTINGS.—Bulletin G-2 issued by the Crouse-Hinds Company, Syracuse, N. Y., describes its "Groundlets" and other safety circuit devices. Diagrams of suggested types of construction for standardized grounding regulations are included.

STATION OIL CIRCUIT BREAKERS.—The General Electric Company, Schenectady, N. Y., is distributing bulletins Nos. GEA-101A and GEA-706, covering its station oil circuit breakers, types FK, FKO, FHK and FHKO-236 and types FK-230 and FHK-230 respectively.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

RANDOLPH, N. H.—Authority has been granted the Twin State Gas & Electric Company, Gorham, to extend its transmission lines to Randolph.

STAMFORD, CONN.—The Stamford Gas & Electric Company plans to build a new office and operating building. Howard Chapman, 315 Fifth Avenue, New York, is architect.

Middle Atlantic States

ALBANY, N. Y.—Plans are being prepared by H. R. Rogers, 467 Broadway, for the Board of Supervisors of Albany County for an almshouse to be erected on Shaker Road in Colonial Township, about 9 miles from Albany, to cost about $250,000. Plans are being considered for a power plant, penitentiary, hospital and nurses home. The total cost is estimated at $2,500,000.

CATO, N. Y.—Plans are under way by Mills Brothers, Sodus, which have taken over the property of the Northern Cayuga Light & Power Corporation for the construction of a hydro-electric plant, to be located about 2 miles north of Wallington.

PHILADELPHIA, PA.—Bids will soon be asked on revised plans by the Board of Trustees, Mt. Sinai Hospital, 1425 South Fifth Street, for alterations and improvements in the power house at the institution, including additional equipment. Magaziner, Eberhard & Harris, 603 Chestnut Street, are architects.

HAGERSTOWN, MD.—Application has been made by the Potomac Edison Company to the Public Service Commission, for permission to extend its transmission line into Montgomery County.

SNOW HILL, MD.—The Eastern Shore Gas & Electric Company, Salisbury, which has purchased the municipal electric plant, plans to erect a 23,000-volt transmission line from Berlin to Snow Hill about 15 miles. The local distributing system will be changed from direct to alternating current.

HOPEWELL, VA.—The contract for the construction of a steam electric generating plant for the Atmospheric Nitrogen Company has been awarded to Stone & Webster, Inc., 147 Milk Street, Boston. The cost of the power plant is estimated at $8,500,000.

PURCELLVILLE, VA.—Permission has been granted the Loudoun Light & Power Company by the County Board of Supervisors to extend its service into Clarke County to supply electricity to residents on the mountains. The company, it is understood, plans to use the poles of the Snickerville Telephone Company.

WASHINGTON, D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, until July 27, for power plant equipment for the local naval hospital (Specification 5334).

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Washington, until July 26, for a quantity of insulated cable and wire, for eastern and western yards (Schedules 7429-7432).

North Central States

ALLEGAN, MICH.—Arrangements are being made by the City Council for the construction of a municipal hydro-electric plant on the Kalamazoo River, to cost $450,000. A special election has been called to vote on a bond issue of $185,000 for the initial work.

CLEVELAND, OHIO.—Separate bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until July 29, for economizers and weatherproof copper wire for the division of light and power.

COLUMBUS, OHIO.—Plans are being prepared by J. N. Bradford, for the Board of trustees of Ohio State University for a power plant to be erected on the university campus, to cost about $125,000.

CHICAGO, ILL.—Permission has been granted the Illinois Power & Light Corporation to erect a 63,000-volt transmission line in Madison and Macoupin Counties.

FOND DU LAC, WIS.—The Wisconsin Power & Light Company plans to erect a 66,000-volt transmission line between Fond du Lac and Ripon, to cost about $150,000. A new substation will be built at Fond du Lac and Ripon, and the substation at Beaver Dam will be rebuilt.

MARSHALL, MINN.—Bids will be received by the city of Marshall until July 28 for the construction of an engine house for the municipal electric plant, to cost about $12,000. Silas Jacobson, St. Paul, is architect.

Southern States

GASTONIA, N. C.—Bids will be received by the City Council until July 29, for a gas engine-driven electric generator unit, and auxiliary equipment, in connection with power house extension for the municipal sewerage system. William M. Piatt, Durham, N. C., is engineer.

JEFFERSON, N. C.—The Jefferson Power & Light Company is planning to purchase a 700-hp. waterwheel, 700-kw. electric generator, and auxiliary equipment, and materials for a 40-mile transmission line.

JACKSONVILLE, FLA.—Bids will be received by the Board of City Commissioners, until Aug. 1, for automatic combustion control equipment, and other apparatus for municipal power service. The Scofield Engineering Company, Commercial Trust Building, Philadelphia, Pa., is engineer.

BIRMINGHAM, ALA.—Bids will be received at the office of the supervising architect, Washington, D. C., until Aug. 15 for furnishing and installing two passenger elevators in the United States post office, Birmingham. For details see Searchlight section.

AMORY, MISS.—Bids will be received by the city of Amory until Aug. 2 for a Diesel oil engine and generator.

CLARKSDALE, MISS.—The Mississippi Power & Light Company, Jackson, has acquired a local site on which it proposes to build a substation, to cost about $50,000. Transmission line extensions will be made to Summer, Webb and vicinity.

PICAYUNE, MISS.—Bids will be received by the City Council until Aug. 4, for the installation of an ornamental lighting system in the downtown district, comprising 54 single-lamp standards. Henry A. Mentz, Hammond, La., is engineer.

CUSHING, OKLA.—Plans are under consideration for the installation of an ornamental lighting system, for which 200 ornamental lamp posts and 19,000 ft. of armored cable will be required.

LEEDY, OKLA.—The Southwestern Light & Power Company, Oklahoma City, contemplates extending its transmission lines to Leedy, Bessie and vicinity, where municipal lighting plants have been acquired.

SAYRE, OKLA.—The Southwestern Light & Power Company plans to erect a 33,000-volt line to Sayre, 18 miles long, and a distribution system in Erick. The cost of the work is estimated at $45,000.

ABILENE, TEX.—Plans are under way by the West Texas Utilities Company to erect a transmission line from San Angelo to Crane County, 150 miles long, to supply electric service to Mertzon, Sherwood, Bernhart, Big Lake, and other towns in that section. The company also plans to build a steam-driven generating plant about 20 miles from San Angelo. The cost of the work is estimated at $2,000,000.

AUSTIN, TEX.—The Central Power & Light Company, San Antonio, has been granted permission by the Board of Water Engineers to make a survey for impounding 20,000 acre ft. of water from the Colorado River for power development.

BALMORHEA, TEX.—The Borderland Utilities Company is planning the construction of a local steam-driven electric plant. A transmission line will be erected for service at Madera Springs and vicinity. An ice plant is also under consideration.

POST, TEX.—The Texas Utilities Company, Plainview, plans to erect a transmission line from Southland to Post, 20 miles long.

WICHITA FALLS, TEX.—Plans are under way by the Texas Electric Service Company for the erection of a high-tension line from Wichita Falls to Burkburnett, to cost about $275,000.

Pacific and Mountain States

HOQUIAM, WASH.—Plans for the proposed local pulp and paper mill to be built by the Grays Harbor Pulp Company to cost about $2,000,000, include a power plant. V. D. Simons, 435 North Michigan Boulevard, Chicago, is engineer.

SEATTLE, WASH.—All bids submitted for a 130-ton electric hoist and traveling table for the Engineering Department have been rejected. New bids will soon be asked for. The cost of the equipment is estimated at between $25,000 and $30,000.

EUGENE, ORE.—Bonds to the amount of $1,250,000 have been authorized for the purpose of building a municipal hydro-electric plant on the McKenzie River. The first unit when completed will bring the total power capacity of the city to 16,000 hp. Two additional units will be added later increasing the capacity of the municipal plants to 75,000 hp.

BAY POINT, CAL.—Plans are under way by the Bay Point Light & Power Company for the construction of a substation to cost about $30,000.

SAN FRANCISCO, CAL.—Permission has been granted the Pacific Gas & Electric Company to use the Church Street conduit of the city for an electric line that will supply electric power to the Duboce route of the municipal railway. The company plans to build a substation at Ninth Avenue and Judah Street, to cost about $225,000.

MILES CITY, MONT.—The Minnesota Northern Power Company, Minneapolis, Minn., which acquired the municipal electric plant, is planning to erect a transmission line in this district.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 28, 1927)

1,633,573. ELECTRIC HEATER; A. W. Daniel, New Orleans, La. App. filed July 1, 1926. Combined fan and heating element.

1,633,576. PROTECTIVE COATING; C. H. Franks, La Grange, Ill. App. filed Aug. 26, 1925. For a magnet coil. Consisting of coalesced fibers of a cellulose derivative.

1,633,577. ELECTRICAL COIL; C. H. Franks, La Grange, Ill. App. filed Dec. 22, 1925. Having protective coatings.

1,633,578. ELECTRIC SWITCH; H. J. Frank, Detroit, Mich. App. filed Sept. 17, 1921. Safety type.

1,633,583. ELECTRIC BELL; W. F. Hendry, Ossining, N. Y. App. filed July 15, 1924.

1,633,647. ELECTRICAL DIMMER SWITCH; W. Row, Melbourne, Victoria, Australia. App. filed Nov. 2, 1925.

1,633,657. TIME-LOCK INDICATOR; T. C. Adams, H. A. Noyes and E. G. Lawrence, Minneapolis, Minn. App. filed Sept. 27, 1924.

1,633,668. DUPLEX RECEPTACLE; W. Ile, Jackson, Mich. App. filed May 5, 1926.

1,633,671. GENERATOR REGULATION; B. M. Leece, Cleveland, Ohio. App. filed Dec. 10, 1925. For starting and lighting systems.

1,633,713. COMPOUND SYSTEM FOR TRANSMITTING A PLURALITY OF VALUES; E. Roucka, Blansko, Czechoslovakia. App. filed Jan. 15, 1924. Such as the flow of a fluid, the pressure thereof and the temperature.

1,633,727. LOOM LOCK; R. B. Early, Riverside, Cal. App. filed May 12, 1925. For securing loom in terminal boxes.

1,633,740. DYNAMO BRUSH; N. R. Haas, Dayton, Ohio. App. filed Dec. 1, 1924. Method of making a dynamo brush which consists in mixing graphite and silicic acid in a dry state and in molding the mixture under heat and pressure.

1,633,741. MACHINE FOR TIGHTENING THE INSULATION APPLIED ON WINDING BARS OF ELECTRIC MACHINES AND APPARATUS; E. Haefely, Basel, Switzerland. App. filed March 8, 1923.

1,633,747. ELECTRIC HEATING APPARATUS; C. E. Johnson, Detroit, Mich. App. filed July 30, 1925. For heating water in bathtubs and the like.

1,633,780. ELECTRICAL GENERATING SYSTEM; J. T. Fitzsimmons, Dayton, Ohio. App. filed March 14, 1925. Lighting and ignition unit.

1,633,801. ELECTRICAL HEATING APPLIANCE; M. S. Williams, Los Angeles, Cal. App. filed June 9, 1925. Can be readily attached to a fan frame for heating air forced therethrough.

1,633,804. SYSTEM OF ELECTRICAL DISTRIBUTION; E. M. Bill, Schenectady, N. Y. App. filed Feb. 8, 1921. In which a plurality of sources of electric energy are adapted to be connected automatically to a common network in response to predetermined conditions indicating the demand for them.

1,633,808. REGULATING SYSTEM FOR DYNAMO-ELECTRIC MACHINES; R. E. Doherty, Scotia, N. Y. App. filed May 9, 1925. For synchronous alternating-current machines on high-voltage, long-distance power-transmission systems.

1,633,812. ELECTROMAGNETIC OPERATING MEANS AND MOTOR CONTROLLER EMPLOYING THE SAME; R. W. Goff, Schenectady, N. Y. App. filed April 18, 1925.

1,633,815. ELECTRIC TERMINAL; F. C. Kelley, Schenectady, N. Y. App. filed Sept. 14, 1925. Adapted for attachment to carbonaceous bodies, such as brushes.

1,633,822. SYSTEM OF MOTOR CONTROL; N. Minorsky, Philadelphia, Pa. App. filed Sept. 1, 1925. For automatically maintaining a predetermined relation between the speeds of a plurality of separate driving motors.

1,633,825. REVERSING CONTROLLER; A. C. Prescott, East Orange, N. J. App. filed Jan. 30, 1926.

1,633,831. REGULATING SYSTEM; L. W. Thompson, Schenectady, N. Y. App. filed April 21, 1924. With anti-hunting means.

1,633,832. FUSE PLUG; J. C. Tournier, Schenectady, N. Y. App. filed May 2, 1924. Magazine type.

1,633,833. MOTOR CONTROLLER; G. R. Townsend, Schenectady, N. Y. App. filed April 1, 1925. For the automatic establishment of motor-running connections after the establishment of the motor-starting connections.

1,633,860. SYSTEM OF DISTRIBUTION; M. Herklotz, Berlin, Germany. App. filed March 20, 1924. In which a plurality of sources of alternating current supply a common distributing system, and in which it is desirable to control the power factor of one of the sources.

1,633,867. CONDUCTOR SUPPORT; S. S. Matthes, Mansfield, Ohio. App. filed Sept. 2, 1925. The conductor is gripped and supported from an auxiliary wire, which may be of copper or steel.

1,633,891. NON-SYNCHRONOUS MOTOR; V. A. Fynn, St. Louis, Mo. App. filed Oct. 22, 1926. Polyphase induction motor with power-factor control. A means for starting such motors.

1,633,912. INDICATING OHMMETER; C. E. Vawter, Philadelphia, Pa. App. filed Jan. 7, 1922.

1,633,938. SYNCHRONOUS-MOTOR STARTER; W. C. Goodwin, Pittsburgh, Pa. App. filed July 30, 1920. Automatic.

1,633,954. WAFFLE IRON; J. H. Procter, Wilkinsburg, Pa. App. filed Sept. 12, 1925.

1,633,955. ELECTRICAL FUSE; D. G. Robinson, Weymouth, England. App. filed April 7, 1925. Cartridge or spring-clip type for 6-volt circuits.

1,633,965. MOTOR-STARTING SYSTEM; R. J. Wensley, Edgewood Park, Pa. App. filed June 3, 1920. For starting synchronous motors.

1,633,967. ELECTRIC FURNACE; J. C. Woodson, East Pittsburgh, Pa. App. filed Oct. 1, 1925. Resistor type.

1,633,969. CIRCUIT BREAKER; C. Aalborg, Pittsburgh, Pa. App. filed March 15, 1922. Wherein certain of the magnetic forces set up during the passage of current through the conductors and contact members are utilized to secure a more effective engagement between the relatively movable contact members and to provide an improved form and arrangement of auxiliary contact members or arcing tips.

1,633,971. FUSE MECHANISM; H. G. Baxter, Baldwin, N. Y. App. filed Jan. 20, 1921. Employed on panelboards and like structures.

1,633,973. REMOTE METERING SYSTEM; P. A. Borden, Toronto, Ontario, Canada. App. filed Nov. 22, 1924. Apparatus for measuring the volt-amperes traversing an alternating-current circuit and for transmitting an indication of the same to a remote point.

1,633,974. ELECTRICAL CONNECTER; E. W. Breisch, Edgewood, Pa. App. filed Oct. 23, 1920.

1,633,979. DISCONNECTING SWITCH; H. J. Crabbs, Pittsburgh, Pa. App filed Sept. 20, 1923. Single-throw or double-throw knife-blade switch.

1,634,006. DRY CELL; V. Yngve, South Orange, N. J. App. filed Jan. 12, 1925. The method of preparing a dry-cell mixture which consists in milling together separate dry depolarizing and carbonaceous materials and a salt and then adding electrolyte to the milled product.

1,634,046. ELECTRIC HEATER; R. S. Smart, Ottawa, Ontario, Canada. App. filed May 14, 1917. Bowl-reflecting type.

1,634,065. CONNECTER FOR ELECTRICAL CONDUCTORS; E. R. Barany Brooklyn, N. Y. App. filed March 14, 1925. Spring-clip type.

1,634,083. TIMER FOR ELECTRICALLY OPERATED DEVICES; E. A. Rutenber, Milwaukee, Wis. App. filed April 24, 1924.

1,634,098. ELECTRIC METER AND THE MOUNTING THEREOF; F. W. Erickson, Larchmont, N. Y. App. filed April 15, 1926.

1,634,121. INTERLOCKING SWITCH MECHANISM; J. E. Sederholm, St. Paul, Minn. App. filed Aug. 2, 1924. Particularly adapted for use in connection with ordinary knife switches such as are commonly used to control electric circuits.

1,634,173. SOCKET TERMINAL; F. C. Chadwick, Newark, N. J. App. filed Nov. 18, 1921. Plug socket adapted in connecting load wires to the terminals of electric irons.

1,634,176. INDICATOR; W. Cunliffe, Stamford, Conn. App. filed Nov. 3, 1924. Electrolyte indicator for storage batteries.

1,634,179. SWITCH; U. Feichter, Chicago, Ill. App. filed April 18, 1925. That may be operated by the reciprocatory action of a single push-button.

1,634,185. DOUBLE-THROW SWITCH; M. Guett, Hartford, Conn. App. filed July 1, 1925. In which a reciprocating carrier is operated by a switch lever or push-buttons.

1,634,201. GLOW-DISCHARGE TUBE; J. Massolle and J. Engl, Berlin-Grunewald, and H. Vogt, Berlin-Wilmersdorf, Germany. App. filed March 20, 1922.

(Issued July 5, 1927)

16,667 (reissue). MEANS FOR REPRODUCING POSITION; E. M. Hewlett and W. W. Willard, Schenectady, N. Y. App. filed May 10, 1927.

1,634,280. STORAGE-BATTERY TERMINAL; E. E. Zastrow, Chanute, Kan. App. filed Aug. 13, 1926.

1,634,309. ILLUMINATED ADVERTISING DEVICE; W. G. Shelton, New York, N. Y. App. filed Sept. 18, 1922. Making use of Geissler tubes.

1,634,365. ELECTRIC FORGE; G. A. Jones, New London, Conn. App. filed Dec. 20, 1920.

1,634,379. THERMOSTATIC APPARATUS; J. W. Myers, Jackson, Mich. App. filed Dec. 20, 1923. As applied to a flatiron.

1,634,381. MEANS FOR ADJUSTING ELECTRICAL CONTACTS; L. L. Nettleton, Edgewood Borough, Pa. App. filed Oct. 21, 1926.

1,634,418. LAMP-SOCKET SWITCH; D. D. Gordon, Chicago, Ill. App. filed April 14, 1921. Pull-chain type.

1,634,431. FLATIRON; J. W. Myers, Jackson, Mich. App. filed Jan. 8, 1925. Automatically regulated.

1,634,479, 1,634,480. ELECTRIC FURNACE APPARATUS AND PROCESS OF REVIVIFYING DECOLORIZING CARBON, ETC.; L. Wickenden, Flushing, N. Y., and W. F. Demmerle, New York, N. Y. Apps. filed July 3, 1922, and March 22, 1923.

1,634,483. ELECTRODE CONTROL FOR ARC FURNACES; T. F. Baily, Alliance, Ohio. App. filed May 24, 1926.

1,634,527. STORAGE BATTERY; W. H. Wood, South Euclid, Ohio. App. filed Oct. 15, 1924. Lead type.

1,634,546. MEANS FOR MEASURING THE FLOW OF ELECTRIC CURRENT IN A THREE-WIRE CIRCUIT; S. L. Lines, Toronto, Ontario, Canada. App. filed Dec. 5, 1923.

1,634,601. DISTRIBUTION SYSTEM FOR SELECTIVE CONNECTIONS THERETO OF FEEDERS; N. Togami, Saga-Ken, Japan. App. filed May 16, 1924.

1,634,620. UNIT-CIRCUIT CONTROLLER; R. C. Leake, Rochester, N. Y. App. filed Aug. 31, 1917. For devices such as clockwork time releases.

1,634,624. AUTOMATIC ELECTRIC ARC-WELDING DEVICE AND METHOD OF OPERATING THE SAME; H. D. Morton, New York, N. Y. App. filed Jan. 16, 1924.

1,634,663. SEARCHLIGHT; T. Hall, Brooklyn, N. Y. App. filed Jan. 13, 1920.

1,634,665. CONTROL MECHANISM FOR MOTOR-ACTUATED DOORS; F. Hedley, Yonkers, N. Y., and J. S. Doyle, Mount Vernon, N. Y. App. filed April 11, 1921.

1,634,674, 1,634,675. METHOD OF CONNECTING METALLIC ELEMENTS; R. Mattice, Bethlehem, Pa. App. filed July 17 and Aug. 21, 1925. As H-beams or the like by electric welding.

1,634,678. TERMINAL STRUCTURE FOR RAIL BONDS; K. J. Mosebach, Pittsburgh, Pa. App. filed June 23, 1925.

1,634,689. ELECTRICAL TERMINAL; E. Schenk, Pittsburgh, Pa. App. filed Nov. 13, 1924. For rail bonds.

1,634,704. WATER HEATER; H. Brand, Berlin, Germany. App. filed Dec. 20, 1926.

1,634,719. HEATER FOR TRANSFORMER OIL; D. G. McArn, Pittsburgh, Pa. App. filed March 23, 1926.

1,634,770. DYNAMO; J. G. Campbell, Dayton, Ohio. App. filed Oct. 14, 1925. Brushes and brush rigging.

1,634,801. PORTABLE HAND TOOL; F. Schneider, Cleveland, Ohio. App. filed May 9, 1923.

1,634,810. RENEWABLE FUSE PLUG; H. J. Wheeler, Kansas City, Mo. App. filed June 14, 1926.

1,634,822. SNAP SWITCH; T. A. Both, Stratford, Conn. App. filed Sept. 5, 1922.

1,634,849. ELECTROPLATING MACHINE; E. B. Powell, Newark, N. J. App. filed July 16, 1926. In which means are provided for mechanically transferring articles to be plated from one tank to another.

1,634,850. ELECTRIC BATTERY AND PROCESS OF MAKING THE SAME; E. Powers, Denver, Col. App. filed June 8, 1926. Storage battery using a semi-solid electrolyte.

1,634,852. ELECTRIC MOTOR; H. K. Sandell, Chicago, Ill. App. filed March 27, 1924.

1,634,853. TRANSFORMING SYSTEM; H. K. Sandell, Chicago, Ill. App. filed March 27, 1924.

1,634,905. FUSE PLUG AND SOCKET; C. B. Jones, Cynwyd, Pa. App. filed March 29, 1921.

1,634,941. SIGNALING SYSTEM; E. M. Hewlett and W. W. Willard, Schenectady, N. Y. App. filed Nov. 22, 1924. Means for indicating the operation of a protective device in an electric circuit.